In This Issue: War Service of Electrical Energy

JOURNAL OF ELECTRICITY

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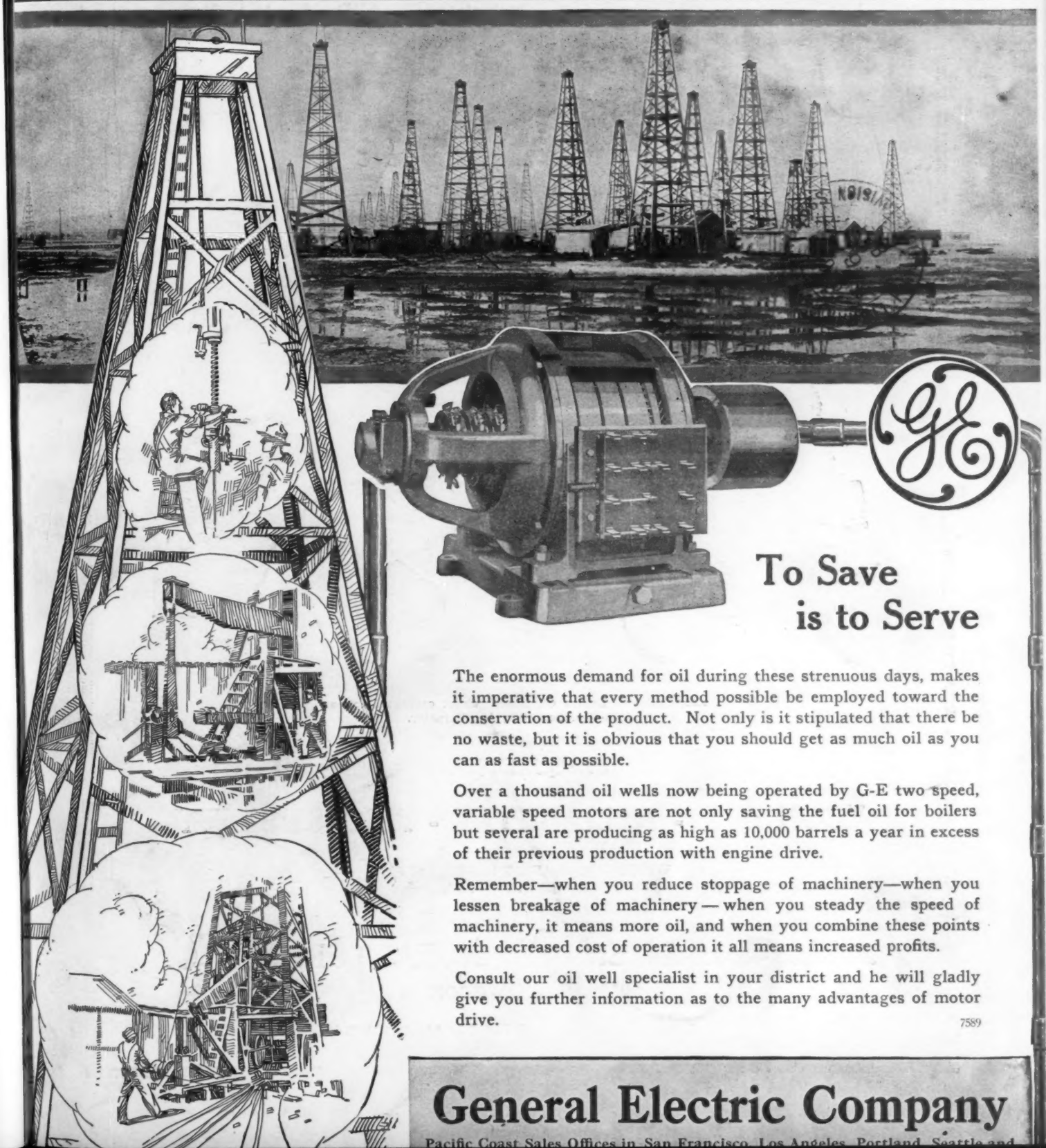

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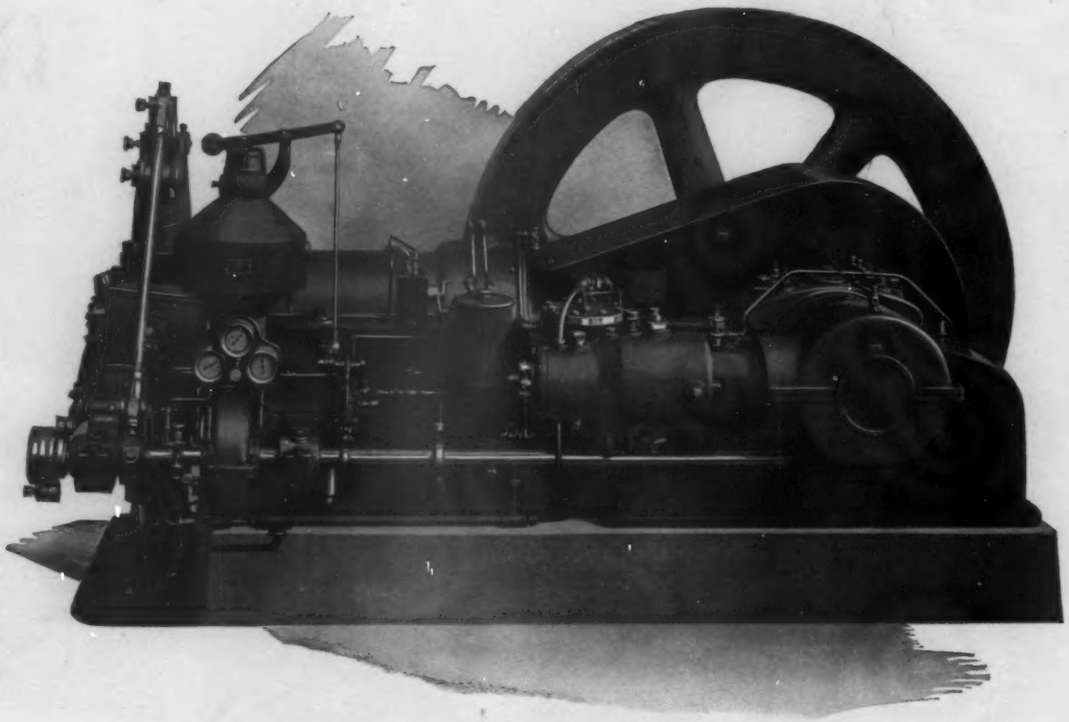

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JOURNAL OF ELECTRICITY

FOUNDED 1887

ROBERT SIBLEY, Editor — CLOTILDE GRUNSKY, Associate

VOLUME 40 — SAN FRANCISCO, FEBRUARY 1, 1918 — NUMBER 3

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HOW THE UPBUILDING OF THE WEST IS HELPING TO WIN THE WAR—VI

Fuel oil, typified in its war production by the giant gusher shown above, is today being mined in the West at the rate of almost a hundred million barrels annually. But in these momentous times electrical energy from the waters of the high Sierras is carrying the increasing burden, not alone in agriculture and industry but in the drilling and the pumping of the oil itself.

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JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 40 SAN FRANCISCO, FEBRUARY 1, 1918 Number 3

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AFTER-THE-WAR VALUE OF WAR SERVICE

The war service of electrical energy in the West, which is discussed at considerable length on other pages of this issue, has a deep and significant meaning for the future commercial and industrial activity of this growing section.

The building of a new power plant at this period, or the installation of a new industry, or even the breaking in of new agricultural land hitherto unproductive, is today the linking of activities that, harmoniously joined with national effort from all other quarters, means the successful termination of the world struggle for democracy. This in itself justifies the immense outlay of agricultural and industrial development now under way in the West.

But beneath it all there is even a deeper, fuller meaning. The harnessing of water power in the mountain fastnesses is the creation of industrial wealth that neither the ravages of war nor the elements of the passing seasons can wear out or diminish in the slightest degree. So long as the sun continues operative in drawing up the vapory supply from the rivers, lakes and oceans, and so long as the mountain fastnesses are blessed with nature's seasonal downpour, so long will activities set in motion during this trying period of the world's history be available in helpfulness and blessings for man.

When we of the West, as a consequence, view the mighty shipbuilding now under way in our sea ports, the giant industries that are springing up on all hands in a district hitherto unaccustomed to such activities, or the increasing production of agricultural wealth in the fertile valleys of the West—in all of which electrical energy is playing an indisputable part—it is difficult indeed to fully estimate the after-the-war value of such war service.

Suffice it to say, however, that the prestige that is being gained from our coast shipping points and the increasing availability of the splendid water powers of the West for industry and agriculture, unquestionably means the building of a commercial empire that is destined to play an invaluable role of helpfulness in the reconstruction years after the war, and as a consequence, war service in the West in electrical lines, has a substantiality to it that is as permanent for the future as it is potent in its patriotic effect at the present.

Interconnection of Power Plants

Editorial comment on the power crisis was set forth in the issue of the Journal of Electricity for January 1, 1918, in which the governmental authorities at Washington were urged to pass needed legislation looking toward a more liberal policy of water power development upon the national domain. At that time it was suggested that the power companies themselves could hasten action by more unified and effective interconnection of service and other economies, the result of which would convince the federal authorities of the justness of this request.

It is gratifying to note that the federal authorities are following this suggestion at Washington, and that a marked attitude of mutual willingness on the part of the power companies to take advantage of interconnection economies is being felt in all sections of the West.

Southern California is now soon to be one vast network of interconnection, which will include the joining of the Southern Sierra Power Company, the Southern California Edison Company, and the San Diego Consolidated Gas & Electric Company, creating again a world's record in interconnection and length of transmission service.

In Central California a most marked advance has been made in the past semi-monthly period. Hundreds of thousands of barrels of fuel oil are expected to be saved in this district through a war conservation agreement reached recently by the three largest electric power companies of this state.

Under the agreement, the Pacific Gas & Electric Company, the Great Western Power Company, and the Sierra and San Francisco Power Company, serving thirty-eight counties of Central and Northern California with electric power and light, have unified all

their activities for the period of the war, and the amalgamated properties will be operated under one management, headed by P. M. Downing, who is now chief engineer of the electrical department of the Pacific Gas & Electric Company.

Steam generating plants will be closed wherever it can be done without denying good service to the public.

About forty thousand square miles of territory will be included in the unified war-time service, which is perhaps the greatest area in the world served with electric power and light by a single corporation management. Beyond promising to enforce the unified electric service during the war, the power companies have said that the single service will be continued after the war just so long as it may be deemed to be in the public interest.

Again in the Northwest gigantic strides are being made in interconnection. The Pacific Power & Light Company has just recently built 65 miles of 110-kv. line from Pasco to Lind, connecting there with the Washington Water Power Company. The cost, including the new Pasco substation and the dispatching office, is approximately $600,000.

Further to the west, the Pacific Power & Light Company is building a second interconnecting line from Powerdale on the Hood River across the Columbia River on high towers, and connecting with the Northwestern Electric Company at the White Salmon plant. This makes a three-cornered connection with the Pacific Power and Light Company, the Northwestern Electric Company and the Portland Railway, Light & Power Company. The cost of the line was about $125,000.

And, as a final triumph in interconnection, the Washington Water Power Company will soon be connected with the Puget Sound Traction, Light & Power Company. Since the Washington Water Power Company is to the east already connected with the Montana Power Company, this will make one grand system of pulsating electrical energy from Harlowton in Eastern Montana across Idaho to Seattle in the north and Portland to the south.

These movements toward unification are excellent and such willingness to aid in the present national crisis will not be overlooked by the public generally.

Carelessness and the Fire Hazard

"Germany's Great American Ally" is the name that has been applied to fire—and indeed it has done yeoman's service in Germany's cause in these last few months. Almost every morning's newspaper brings report of the destruction of some grain warehouse or factory, a loss that is quite as effective for the enemy's purpose as though a ship had been sunk or a storehouse at the front destroyed. The important point is that each one of these fires reported is due in some measure to carelessness. Whether it be an accidental conflagration—and in the speeding up process of all war industry there are many more opportunities for such accidents—or of incendiary nature, a sufficient watchfulness could have prevented the blaze. At a recent convention of fire underwriters the question of adequate watchman service was brought up. Many companies utilize the position of watchman as a reward for employes incapacitated through age or accident in their service. The futility of such guards was proved time and again in a series of experiments in which the fire deputies found no difficulty in stepping past the watchmen and secreting themselves in the grain elevator or factory, as the case might be.

An interesting series of experiments in the fire tests of building columns has recently been carried on by the National Bureau of Standards, as elsewhere reported in these pages. They should be of interest to any who suffer fire hazards.

The Architect and the Electrical Industry

Closer co-operative helpfulness is possible between the architects and the various branches of the electrical industry. This was recently most forcefully brought out at a meeting of the San Francisco Electrical Development League, devoted to a discussion of this subject, in which discussion a number of noted architects took part.

Louis C. Mullgardt, designer of the lovely Court of the Ages, and Bernard R. Maybeck, designer of the beautiful Palace of Fine Arts at the Panama-Pacific International Exposition, spoke on behalf of the architects and explained that complete co-operation was hindered rather than helped by the volumes of conflicting and confusing literature now issued by the different electrical supply concerns. They said if the electrical people could unite and standardize their requirements — from an architectural standpoint — and express themselves in less technical language, they would facilitate co-operative work on the part of the architects who do not profess to be expert electricians.

The system of separate inspections by municipal and state authorities of electric light and electric power, and steam heat, gaslight and plumbing also tended to baffle the architects. If the electric and power concerns could secure some legislation to consolidate these inspections, the speakers said, it would be a great advantage.

Here is a real service that men of the electrical industry throughout the West can undertake at once. A broad field of greatly enlarged applications of electric lighting and appliances is possible in the home and in buildings generally. The men of the electrical industry would do well to weigh carefully these suggestions and by making their appeal understandable to the architect, much of the confusion, misapplication and misunderstanding of the past may be avoided.

The subject is clearly one of such importance that it should receive the immediate united backing of all branches of the industry.

A Scientific Attitude in Valuation

In this day of national experiment on a large scale, the average layman is impressed more and more with the fact that economics and the problems of business and social balances have not been reduced to an exact science. He still clings to the conviction that there are definite laws which underlie all such reactions to changes, and that if one thought clearly enough with persistent enough logic, he could avoid the mistakes of actions based upon generalities in the dark.

This habit of approximate judgment in business matters is never more striking than where the business field overlaps that of such an exact science as engineering. The problem of the valuation of public utility properties is still one much clouded with conjecture and decided all too often with a mere individual judgment of what is "about fair," rather than upon a recognition of underlying causes and just compensations. Expert testimony in the past has based its opinion upon former court decisions, without recognition of its duty to establish the truth of the situuation as clearly as possible in order that the court might re-decide upon more scientific grounds. The question of the fair rate to be allowed public utilities, or the price to be fixed in condemnation proceedings, is not a matter to be determined by legal enactment at random, but by the facts of the case.

The situation is an extremely live one today. Applications for increased rates for electricity and transportation, in the face of increased operating expenses, are before practically every rate-fixing commission in the country. The tying in of the great power lines and the reorganization and amalgamation of many of the large manufacturing concerns, involve the careful establishing of values.

In this connection the remarkable series of articles by C. E. Grunsky on valuation problems, which have been appearing in the columns of the Journal of Electricity, is of particular interest. A more hopeful attitude for the public utility owner has been adopted recently by various rate-fixing bodies—and new light is being welcomed upon the intricate problems involved. Mr. Grunsky was perhaps the first to point out the necessity for a strictly scientific attitude toward the economic questions involved in valuation, and has contributed much to the present growing spirit of openmindedness. The question of "going value," a discussion of which appears elsewhere under his name, is perhape the most intricate and involved of any problem which confronts the valuation expert, and one which has in the past been determined almost wholly by personal approximations. That there may be a logical determination of the intangible elements involved, as well as of physical properties, is here pointed out and sustained by the recent recognition of the courts.

Engineering Purchases in the Orient

All of us have from time to time heard of the dickerings necessary to make a purchase with the Turk, the Persian, and other Oriental merchants. And so the American engineer now engaged in professional work in the Orient, is not wholly unprepared to question the price asked for various articles of purchase he desires to make.

The question of knowing how to arrive at the real price of Oriental wares is not only of passing interest to the tourist, but is indeed one of vital and economic importance to the engineer or construction company that may have aspirations toward acquiring success in the Orient. For herein lies the success or failure of many such undertakings.

The Oriental character is such that one should not pass judgment too harshly in criticising their system of "two prices." It has been their method of doing business for centuries and to them it is the natural and fair way of arriving at a proper price of sale. In the native mind all salesmanship is considered something in the nature of an auction campaign in which the purchaser states the price at which he will do business and the salesman may take the offer or not at will.

Hence the holding of an open price at which dickering may begin, and the reservation of an unmarked price at which it may cease, is wherein the Oriental mind honestly strives for successful salesmanship. Consequently the holding of two prices is not a reflection upon the honesty of the merchant, but is a racial characteristic upon which the engineer should carefully figure in making his estimates of purchases.

In China the question of two prices is especially pronounced, and yet everyone who has had real business dealings with the Chinese merchant finds him at heart thoroughly honest and willing to abide by his word to the last ditch.

In America we are becoming convinced that the true ethics in the fixing of prices compels us to compute the cost of carrying on a business plus the cost of manufacture, and then add a reasonable amount for profit. This practice is especially noticeable in all the rulings of rate-fixing boards in the handling of public utility problems. Indeed, so convinced are we now becoming of the reasonableness of this fundamental truth that almost all business prices are now being readjusted to meet this law of reasonable returns. No longer does the just and really successful business man attempt to gather as profit all that the traffic will stand, but rather only such a return as he feels justified in making over and above the cost price of production.

In China, however, the old system is in full swing. The merchant considers that you know your business and that you are thoroughly familiar with the proper value of the wares you desire to purchase. As a consequence, he stands by with his figures until he is satisfied he knows your real level of valuations, and if it is of sufficient amount to allow him a profit, he will allow a sale to be made.

Hence it is of utmost importance that one should thoroughly familiarize himself with the real market value of wares and produce of the Far East before attempting to drive a purchase, for the confidence given to one's conscious expression, is of utmost value in closing the deal at a reasonable figure.

THE NEW JOURNAL SERVICE: The increasing activities of the Journal of Electricity have resulted in many requests being made to have the current issues on sale at the various book stands and news stands of the West. In order to meet in a measure this growing demand on the part of the readers of the Journal, current copies of each issue may now be purchased at the leading stands in Berkeley, Oakland, Alameda and San Francisco. This service will be extended to other cities of the West as soon as the outlay seems justifiable. At present, however, the placing of the Journal on the news stands of the cities of the Bay Region, and on all ferry news stands and at the Ferry Building in San Francisco—a building through which pass more people daily than any other building in the world—it is believed that a distinct start is made in making the Journal available to thousands of readers that otherwise would not meet its helpful influence.

THE SNOW SHEDS OF THE SIERRAS

The rugged pinacles of the Sierras bedecked with eternal snows offer opportunities for water storage and consequent maximum power development of some nine million horsepower.

WAR SERVICE OF ELECTRICAL ENERGY

BY ROBERT SIBLEY

(That hydro-electric energy is rendering war service to the nation today in a manner almost beyond human imagination is the firm conviction of those who in these momentous times, scan closely the industrial and agriculutural life of the West. Here is a pictorial exhibit of what the editor of the Journal of Electricity saw while recently making a tour of the great San Joaquin Valley of California—a valley of five million acres, perhaps the largest and most productive agricultural district in the world dependent upon irrigation and fed in large measure by electrically operated pumps.—The Editor.)

An Emergency Overflow from a Power Canal

WHILE the American nation is seemingly engrossed in the flare of trumpets, the beating of drums and the training of men, for the defense of democracy, and the great seaports of the nation resound with the hum of the riveters at work on the building of a giant emergency fleet, this article is written that there may be passed down to all posterity a record of how electrical energy generated in the mountain fastnesses of the West is today making possible the conservation of fuel necessary to maintain our navy and drive the great merchant marine so soon to be ours, and yet at the same time keep the rich agricultural districts of the West in a maximum state of efficiency in supplying our soldiers and sailors with the necessary food products to sustain life and activity in industry at home and service abroad.

And best of all, while this activity is thus rendering an invaluable aid in the present crisis, it is at the same time building up industry and agriculture that add a permanent wealth to the West that will remain throughout all ages.

Long since, the blind poet Milton immortalized these beautiful words, "They also serve who only stand and wait." This waiting attitude with willingness to serve is so wonderfully embodied in the giant power lines of the West that trail their way down from the snow-capped Sierras into a formerly arid waste—a waste that had a solemnity of stillness in its lack of usefulness for man to such a degree that this feature alone at one time gave this section a distinction to greatness in the annals of the nation—as to give a new meaning to the vision of Milton should one apply his saying to the accomplishments of hydro-electric transmission of energy in its service to man.

It is hence the purpose of this article, that the Journal of Electricity in its jubilee year of thirty years of service to the nation, should recount in an authentic and authoritative way, some of the things that go to show how hydro-electric energy in the West presents itself as an invaluable aid in making forever secure the liberties of free peoples and the democracy of the World.

Already there has been invested in hydro-electric

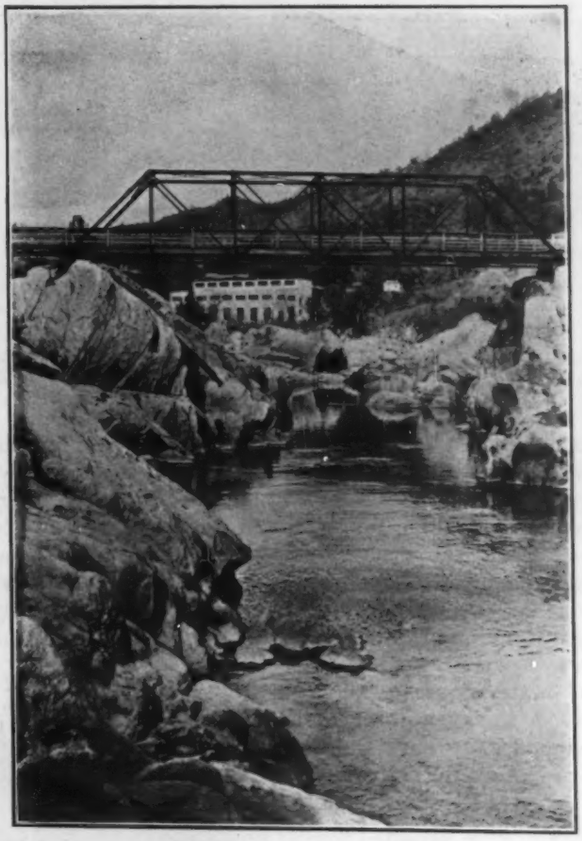
Transporting Heavy Machinery by Motor Truck

activities of the West some three-quarters of a billion dollars and something over eight hundred thousand horsepower of electric energy are as a consequence available for the driving of wheels of industry and the pumping of water for irrigation.

In normal years about 8 per cent of the electrical energy consumed in Southern California is produced by steam electric generation. Due to a growing lack of hydro-electric energy in the West, this proportion increased to 30 per cent in the past year in that section. Fuel oil has increased in value, on the other hand, from a prevailing price of 60 cents per barrel to $1.35, and in some instances $1.55, per barrel. At the same time the fuel oil in storage is decreasing at the rate of 1,000,000 barrels per month. The situation is, as a consequence, serious. If such a condition continues, a marked crippling of agricultural and industrial production must perforce be the outcome.

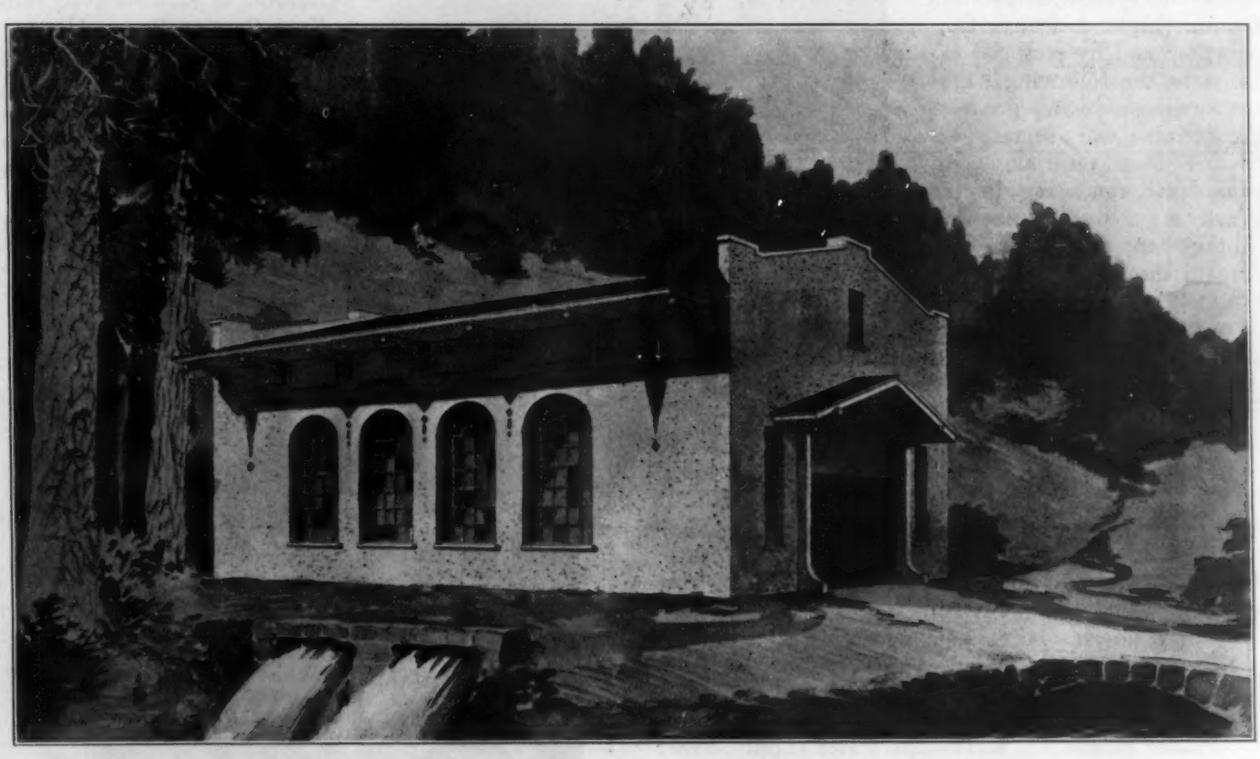
In order that our readers and the public generally may be advised of this situation, and also of the marked service that hydro-electric development is doing to meet this emergency in fuel oil production, an intensive study has been made of a typical hydro-electric utility of the West, that of the San Joaquin Light & Power Corporation, which feeds an agricultural district of some five million acres, perhaps the greatest lay of land in the world served by electrical energy—a lay of land of marked fertility and yet largely dependent upon electrical irrigation pumping for its development.

This company not only generates hydro-electric energy in the high Sierras in a number of different units, but in the great oil district near Bakersfield it has a steam auxiliary for electric generation that has



THE SAN JOAQUIN RIVER

Observe the low flow condition of this river, which is one of the largest in California. The determination of the variation in stream flow is an important factor in war service in the West, as upon this information possible power development is computed.



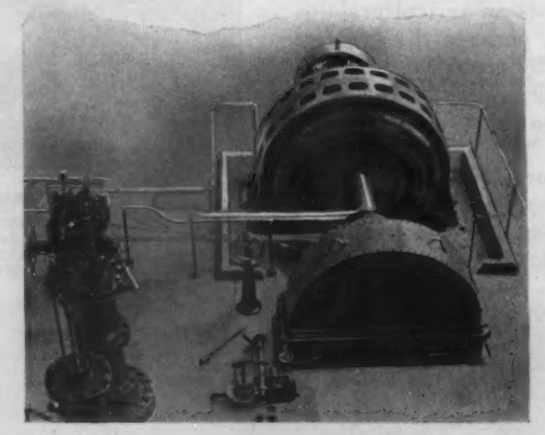
THE SAN JOAQUIN POWER HOUSE NO. 2

Here is a brand new power house which may be designated as a war baby, since its arrival has taken place subsequent to the declaration of war with Germany. Into the pinstock pipes are passed the waters of the north fork of the north fork of the San Joaquin River. These waters are dropped a vertical distance of 306 feet, thus operating a new generator of 3000 kw. installed capacity.

San Joaquin Power House No. 1, of 16,000 kw. Capacity

formerly used a hundred thousand barrels of oil annually for this purpose. As an emergency service, however, the next sixty days will witness this plant operated by natural gas now going to waste. This instance shows how war service ideals are being put into actual operation in the West. Not only this, but the enormous increase of the electric drive in the oil fields during recent months is again a striking feature of war service work, as time, labor and material are again conserved, to say nothing of the financial gain that is accomplished and the introduction of more efficient methods for the building up of industry after the war.

With all these ideas in view, then, we shall first briefly describe the system of the San Joaquin Light & Power Corporation, and by pictorial exhibits in the following pages set forth convincing proof of the genuine war service activities that these companies are rendering in the West. As a consequence immediate governmental encouragement for further development on the public domain should be granted. Indeed, in these splendid privately developed enterprises now so firmly and fairly operating under state utility regulation, a debt of gratitude on the part of the public is due them for the vision and constructive genius that has been displayed.



Interior of the Tule River Power House

The San Joaquin Development

Situated in the heart of the beautiful snow-capped Sierras, an earth and rock fill dam with a reinforced concrete corewall has been constructed to store the water of the north fork of the north fork of the San Joaquin River. In normal years 45,000 acre feet of water is here stored on July 1st of each year.

Three power plants, known as San Joaquin No. 1, No. 2, and No. 3, are fed in succession from these impounded waters in addition to the natural flow of the river.

Power House No. 3 takes its water supply direct from the Crane Valley Reservoir through a ditch which has a carrying capacity of 115 cubic feet of water per second. The water is dropped through penstock pipes a vertical distance of 401 feet, thus generating electrical energy in two 1000 kw. generators.

From an equalizing reservoir of 220 acre feet capacity immediately below Power House No. 3, a recent installation has been perfected designated Power House No. 2, which drops these same waters a vertical distance of 306 feet, thus operating a new generator of 3000 kw. installed capacity.

Again these self same waters, replenished by the waters of the south fork of the north fork, are taken through a third conduit of 135 cubit feet per second capacity and dropped a vertical distance of 1425 feet. This generating plant, known as Power House No. 1, is the largest of the San Joaquin Light & Power Company's system. The total installed capacity is 16,000 kw., generated by four units of equal capacity. A forebay of 22 acre feet is provided at the head of the penstock pipes to take care of fluctuations in load. The water is discharged directly into the main San Joaquin River.

Tule River Power House

The Tule River Power House is located at the confluence of the Nelson and Doyle branches of the Tule River in Tulare county. The Doyle branch only is used, but it is proposed to use the Nelson branch, and some work has been done on the conduit line. Two 3000 kw. units have been installed with this use in mind. The head available is 1550 feet.

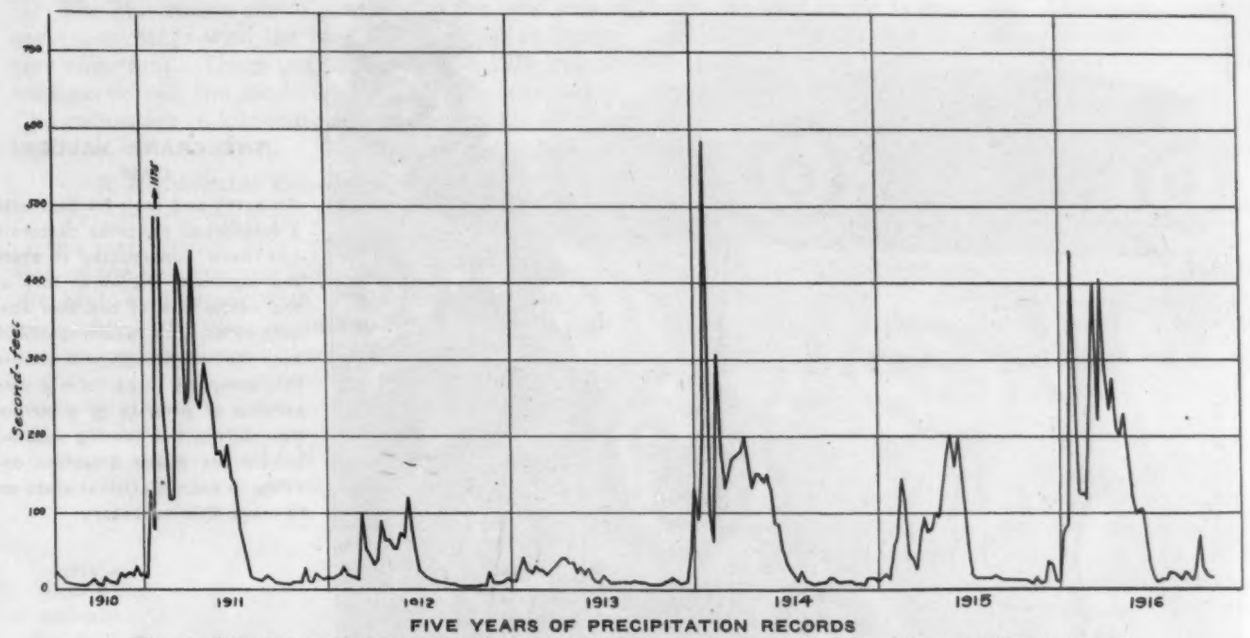
Kern Canyon Power House

As far back as 1896, three 450 kw. units were installed on the Kern River in what is known as the Kern Canyon Power House. The machines have during the past year been replaced with a single 3750 kw. unit and it is the ultimate plan to rebuild the entire plant and increase the capacity to 7500 kw.

Merced Falls Power Plant

Still another power plant of this company is that known as the Merced Falls Power House, which uses

San Joaquin Power House No. 1, installed below the Crane Valley Dam



FIVE YEARS OF PRECIPITATION RECORDS

The carefully computed charts of precipitation kept for several years past now enable this utility to foretell with a remarkable degree of accuracy the possible hydro-electric supply that may be anticipated during these stirring days of war service in industry and agriculture for the approaching season.

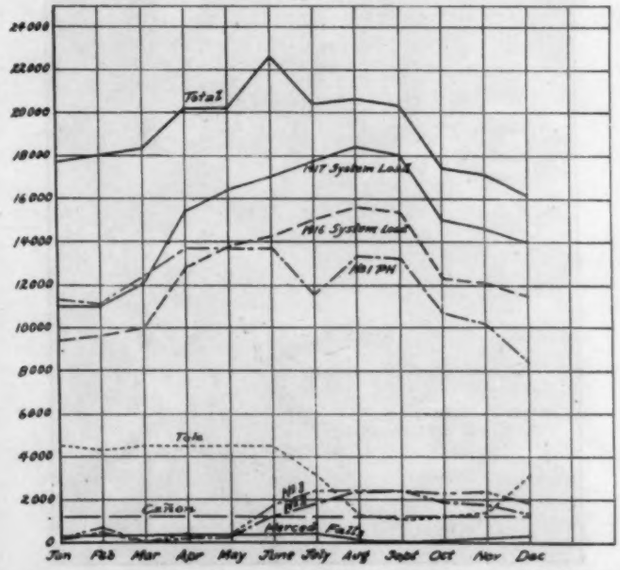
the waters of the Merced River after they emerge from the Yosemite National Park. The plant has two 225 kw. generators which are driven from a single water wheel.

Steam Auxiliary Plants

The Bakersfield steam plant is a modern steam turbine plant of 18,900 horsepower capacity, and there are reserve steam plants in Fresno and Betteravia, that have a combined capacity of 4290 horsepower.

Proposed New Developments

Power developments now under survey by this company aggregating in excess of 100,000 kilowatts capacity, and all power required for future needs of this territory is available in the Sierras bordering on the east.

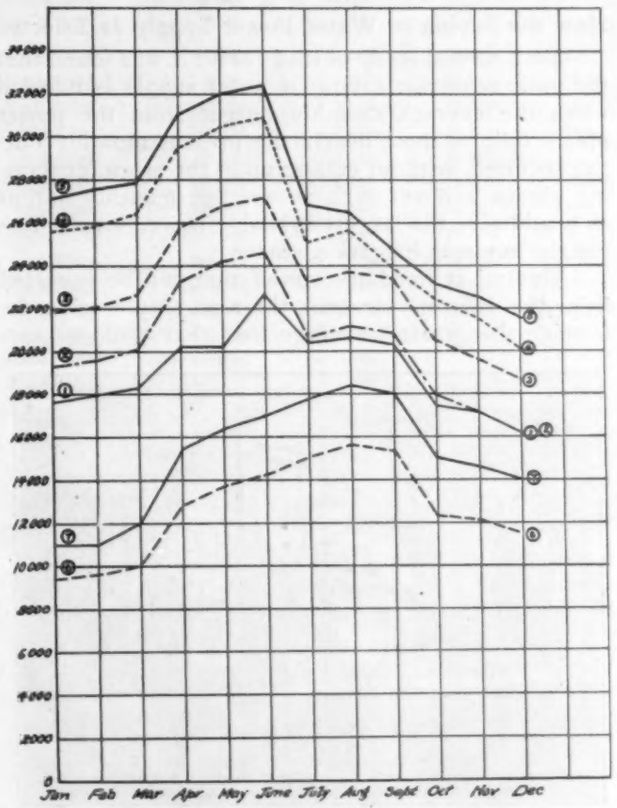


POWER OUTPUT OF THE VARIOUS HYDRO-ELECTRIC UNITS

Continuity of service is an important factor in war supply for industry and agriculture. Here is how the San Joaquin Light & Power Company receives its average load from its generating stations in the mountains.

How the Most Desirable Power Plant Operation Was Obtained

To show how war service of electrical energy has led the managers of this hydro-electric institution to develop the present and future capacity with utmost efficiency and the avoidance of waste effort, a discussion of the method pursued is interesting and timely.



POSSIBLE NEW DEVELOPMENT

In recent stirring months of war service this company has made an intensive study looking toward additional hydro-electric supply. Much of this new development work indicated upon this sheet was installed during the past season.

THE CRANE VALLEY DAM

An earth and rock fill dam with a reinforced concrete corewall, has been constructed to store the waters of the north fork of the north fork of the San Joaquin river. The resulting 45,000 acre feet of storage will enable this company to perform a war service of priority of distribution during the coming season, should the power situation develop to such a critical state as to make this necessary.

In order to determine what load can be carried throughout the year on the hydro-electric plants of the system, with due consideration for additional developments, it was first necessary to make an extensive study of stream flow records over a long period of years. A period of at least five years, including at least one very dry year, was as a consequence determined upon.

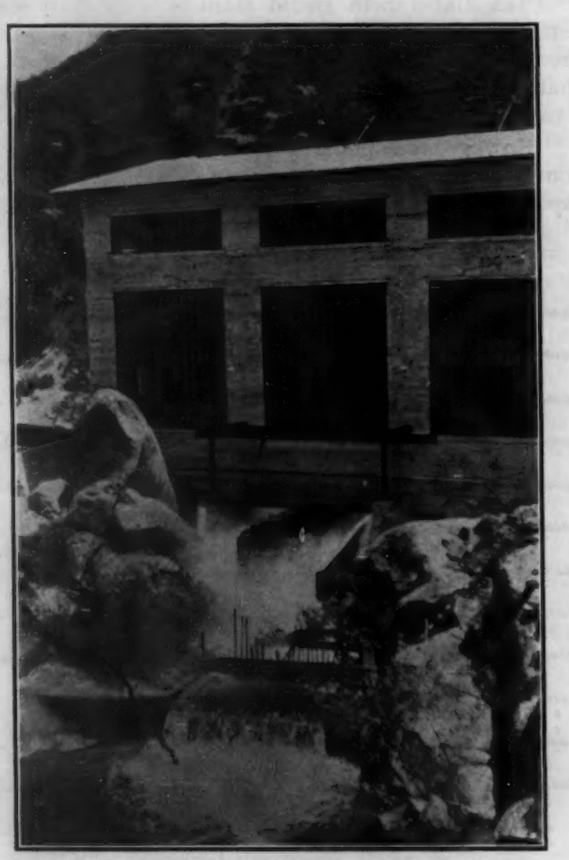
How the Saving in Water Power Supply Is Effected

By a careful study of load curves it was found that the most economic saving of water supply is effected when the average monthly output from the power plants follows most nearly the present monthly output required, without calling upon the steam generating plants, and yet such an average monthly output as would give the largest available power supply during the summer irrigation season.

Having at hand the runoff that can be expected from the different streams, the next step was to determine the greatest average load that could be carried per month on the present system for a year of normal runoff. For the Canyon, Merced Falls, and Tule plants, the load corresponds to the stream flow for the particular month, as shown on the curves for stream flow.

A TYPICAL SUBSTATION IN THE SAN JOAQUIN VALLEY

Here is the manner in which power is taken to the great out-doors in the San Joaquin Valley of California, where some five million acres of cultivatable land may ultimately be served by this company.



THE TULE RIVER POWER HOUSE

This plant, too, may be termed a war baby, in that it was thrown into service after the European struggle was initiated in 1914. Two 3000 kw. units are installed which utilize waters of the Tule River from a 1550-foot vertical drop.

The illustration shows graphically the total power curves, together with the load each station carries to give this total. There is also shown the 1916 system load curve and the assumed 1917 system load curve. The values are in kilowatts and represent the average load that can be carried.

A Remarkable Growth in Load Factor

Perhaps the most remarkable outstanding feature of the war service developments in the power situation of the San Joaquin Light & Power Corporation is the high load factor with which its power supply is maintained. In most communities of the West where the irrigation pumping load plays such an important part, the load factor is very low. Here is a company, on the other hand, that has during the past year operated as high a load factor as 81.8%. But in the strenuous months ahead it is confidently expected that the load factor will be carried as high as 85%. Such distribution of load is indeed true war service to the nation..

In order to get a comprehensive grasp of just how the hydro-electric and steam electric generation is proportioned in this interesting system, the accompanying chart for total output is given in full. This chart gives the monthly operating figures for 1916 and 1917, and also sets forth a proposed chart for the present year.

SAN JOAQUIN LIGHT AND POWER CORPORATION

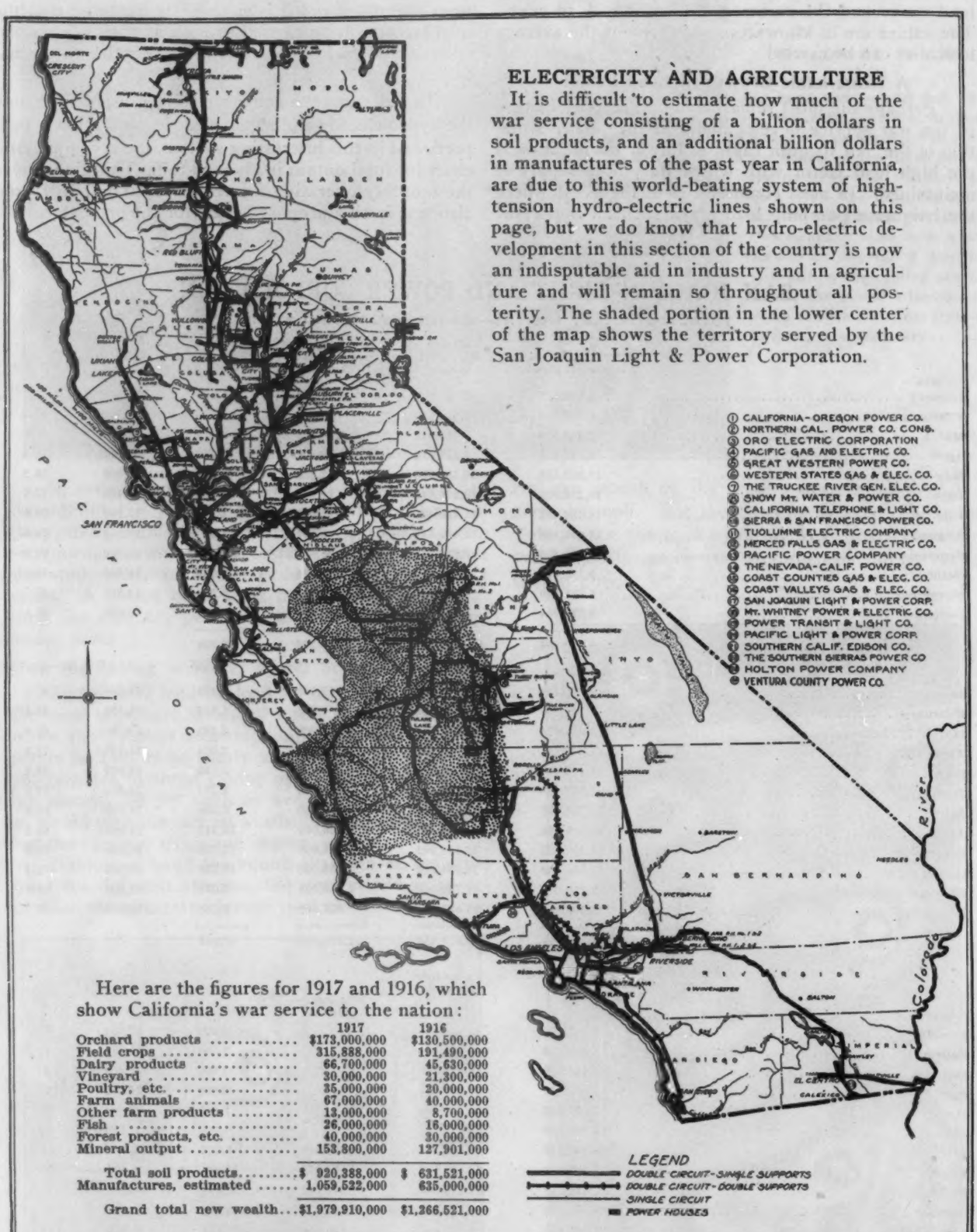
TOTAL OUTPUT BY MONTHS—1916-1918—HYDRO AND STEAM

	System Total Kilowatt Hours	Hydro Kilowatt Hours	Steam Kilowatt Hours	Barrels Fuel Oil Used	System Peak	Load Factor
1916—						
January	7,008,738	6,927,820	80,918	1,910	14,900	63
February	6,676,500	6,616,036	60,464	1,924	13,800	69.5
March	7,405,430	7,249,930	155,500	2,120	14,300	67.2
April	9,182,624	9,176,074	6,550	803	18,900	67.5
May	10,202,504	10,189,908	12,596	1,095	18,000	76.2
June	10,236,902	10,226,642	10,260	961	18,400	77.5
July	11,133,438	11,120,428	13,010	1,136	19,800	75.9
August	11,611,358	11,467,818	143,540	2,940	20,350	76.6
September	11,039,472	10,613,782	425,690	5,067	20,800	73.8
October	9,139,624	8,718,294	421,330	5,780	18,600	66
November	8,711,550	8,395,480	316,070	4,206	18,600	65
December	8,572,754	8,362,054	210,700	4,313	17,600	65.4
Total	110,920,894	109,051,666	1,869,228	32,255		
1917—						
January	8,225,444	8,208,444	17,000	2,104	16,500	67
February	7,348,108	7,343,408	4,700	1,658	15,500	70.5
March	9,034,278	8,947,278	87,000	2,448	18,500	65.6
April	11,079,996	11,036,396	43,600	2,074	21,100	72.9
May	13,116,920	13,043,920	73,000	2,748	23,000	76.6
June	13,252,980	12,407,980	845,000	6,291	23,600	77.9
July	14,756,882	13,768,182	988,700	7,150	24,500	80.9
August	15,219,458	12,854,458	2,365,000	15,312	25,000	81.8
September	14,288,092	11,590,092	2,698,000	17,758	25,100	79.2
October	13,600,000	10,994,000	2,606,000	16,350	25,000	73.4
November	12,800,000	11,760,000	1,040,000	6,970	23,500	72.5
December	12,500,000	11,565,000	935,000	6,180	22,000	73
Total	145,222,158	133,519,158	11,703,000	87,043		
1918—		Economic Possible Hydro Output	Necessary Steam			
January	9,442,150	13,850,000	.....	2,000	17,900	71
February	8,019,716	9,678,000	.....	2,000	16,700	71.5
March	10,663,126	15,319,400	.....	2,000	21,400	67
April	12,977,368	14,817,000	.....	2,000	24,050	75
May	16,031,336	18,420,000	.....	2,000	28,000	77
June	16,268,058	18,209,500	.....	2,000	28,600	79
July	18,380,326	16,981,800	1,398,526	8,226	29,100	85
August	18,827,558	14,639,200	4,188,358	24,598	29,800	85
September	17,536,712	13,671,000	3,865,712	22,740	29,000	84
October	18,060,376	14,372,400	3,687,976	21,694	30,400	80
November	16,888,450	14,312,000	2,576,450	15,155	29,700	79
December	16,427,246	16,409,800	17,446	2,000	27,600	80
Total	179,522,422	180,680,100	15,734,468	106,413		

TRANSMISSION SYSTEMS OF CALIFORNIA

ELECTRICITY AND AGRICULTURE

It is difficult to estimate how much of the war service consisting of a billion dollars in soil products, and an additional billion dollars in manufactures of the past year in California, are due to this world-beating system of high-tension hydro-electric lines shown on this page, but we do know that hydro-electric development in this section of the country is now an indisputable aid in industry and in agriculture and will remain so throughout all posterity. The shaded portion in the lower center of the map shows the territory served by the San Joaquin Light & Power Corporation.


1 CALIFORNIA-OREGON POWER CO.
2 NORTHERN CAL. POWER CO. CONS.
3 ORO ELECTRIC CORPORATION
4 PACIFIC GAS AND ELECTRIC CO.
5 GREAT WESTERN POWER CO.
6 WESTERN STATES GAS & ELEC. CO.
7 THE TRUCKEE RIVER GEN. ELEC. CO.
8 SNOW MT. WATER & POWER CO.
9 CALIFORNIA TELEPHONE & LIGHT CO.
10 SIERRA & SAN FRANCISCO POWER CO.
11 TUOLUMNE ELECTRIC COMPANY
12 MERCED FALLS GAS & ELECTRIC CO.
13 PACIFIC POWER COMPANY
14 THE NEVADA-CALIF. POWER CO.
15 COAST COUNTIES GAS & ELEC. CO.
16 COAST VALLEYS GAS & ELEC. CO.
17 SAN JOAQUIN LIGHT & POWER CORP.
18 MT. WHITNEY POWER & ELECTRIC CO.
19 POWER TRANSIT & LIGHT CO.
20 PACIFIC LIGHT & POWER CORP.
21 SOUTHERN CALIF. EDISON CO.
22 THE SOUTHERN SIERRAS POWER CO
23 HOLTON POWER COMPANY
24 VENTURA COUNTY POWER CO.
SAN FRANCISCO
SAN BERNARDINO
LOS ANGELES
SAN DIEGO
IMPERIAL
INYO
MONO
Colorado River
LEGEND
DOUBLE CIRCUIT-SINGLE SUPPORTS
DOUBLE CIRCUIT-DOUBLE SUPPORTS
SINGLE CIRCUIT
POWER HOUSES

Here are the figures for 1917 and 1916, which show California's war service to the nation:

	1917	1916
Orchard products	$173,000,000	$130,500,000
Field crops	315,888,000	191,490,000
Dairy products	66,700,000	45,630,000
Vineyard	30,000,000	21,300,000
Poultry, etc.	35,000,000	20,000,000
Farm animals	67,000,000	40,000,000
Other farm products	13,000,000	8,700,000
Fish	26,000,000	16,000,000
Forest products, etc.	40,000,000	30,000,000
Mineral output	153,800,000	127,901,000
Total soil products	$ 920,388,000	$ 631,521,000
Manufactures, estimated	1,059,522,000	635,000,000
Grand total new wealth	$1,979,910,000	$1,266,521,000

THE PRODUCT OF THE DESERT BEFORE THE ADVENT OF ELECTRICITY

Here is a view of the desert, studded with the famous Spanish yucca—a picturesque growth in agriculture, but hardly a war-time necessity. In subsequent pages the reader may note the marvel that electricity has wrought in the present production of lands similar in character to that shown above.

WAR SERVICE IN AGRICULTURE

The rattlesnake, the inhabitant of the desert before electricity's advent.

AGRICULTURAL products before the advent of the electrically operated pump, in many parts of the great San Joaquin Valley, consisted largely of the yucca tree and the rattlesnake. Today the transmission lines of the San Joaquin Light & Power Corporation serve thrifty and profitable districts that are wonderfully productive. The success of this company exemplifies to a marked degree what must be the ultimate outcome of a policy of optimism and confidence in a growing and promising community. Five years ago, for instance, an extension of the company's lines was undertaken from Bakersfield northward for a distance of 31 miles to Wasco, through a country that would make many a faint-hearted man wonder if returns would ever justify the outlay. The sole inducement that this company had was a 125 horsepower pumping contract. Today the result of this farsighted policy is simply marvelous. Hundreds upon hundreds of acres of productive farm lands are fed from this extension, and needless to say that the load in electrically operated pumps has increased by leaps and bounds. Many of the illustrations shown on succeeding pages setting forth agricultural production in potatoes, wheat, rice, citrus fruits, wool, hogs, cattle, corn — necessary war food stuffs—are taken from this district. This company, following the policy of building into wild and untilled territory, needing water alone to make it productive, has in these recent months completely justified these great outlays of five years ago. As a consequence, its load factor approaching near the 85% mark, stands out as unique in hydro-electric development.

Statistics from the Chamber of Commerce of Kern County, in which the Wasco extension is located, give emphatic evidence of this growing use of electrical energy and the splendid war service that has been rendered during the past year. Thus, during the past year, the acreage planted to corn has been increased to 25,000 as against 16,000 in 1916; in potatoes the acreage has increased to 1200 as compared with 300 in 1916, while wheat and barley have increased by over 3000 acres in the past year.

Four years ago, rice for the first time was planted. As an experiment two acres were devoted to this product. This year this county expects to ship 72 cars of the finished product. The first sugar beets were planted in the county in 1914. This year this district harvested 6000 acres. Beans, another new crop in this district, is proving a revenue producer for the farmer, as is the alfalfa, the dairy and the hog industry. The alfalfa, of which the district has close to 100,000 acres, has made rapid strides, under the pump system, which has indeed been a welcome adjunct to agriculture.

But this is only a statement of one small part of the great territory served by the San Joaquin Light & Power Corporation. The entire territory served constitutes an empire of five million acres of cultivatable land—an empire vast and overflowing with possibilities for future intensive development.

Electricity the Pioneer

Where the great power lines stretch across the desert—is the promise of tomorrow. First power, then water, then corn and beans and pork and sugar beets to feed the world. Day by day, served by the power from these thread-like wires, the acres are being reclaimed from desolation to service—war service—and beyond that, a permanent gain to the storehouses of the world.

The Begining of a Farm

A little house, a shed, an electrically driven pump—just a dot upon the desert. But it is just such beginnings as these which have made possible the 50 per cent increase in output for 1917 which is the boast of California's agriculture. Every acre put under cultivation is clear gain, from the harnessing of water power otherwise run to waste, to the forcing back of the desert frontier.

Storing Water in the Night

To get the full benefit of the pumping plant, the farmer provides a small reservoir to store the water pumped during the night. An idea of the difference in the problems of the farmer of the West and of the East is glimpsed here. For your Western rancher must not only be a good agriculturist, but something of an engineer and electrician as well. The picture shows a windmill, a gas engine and an electric pump installed—with electricity winning out.

Electrically Made Pipe

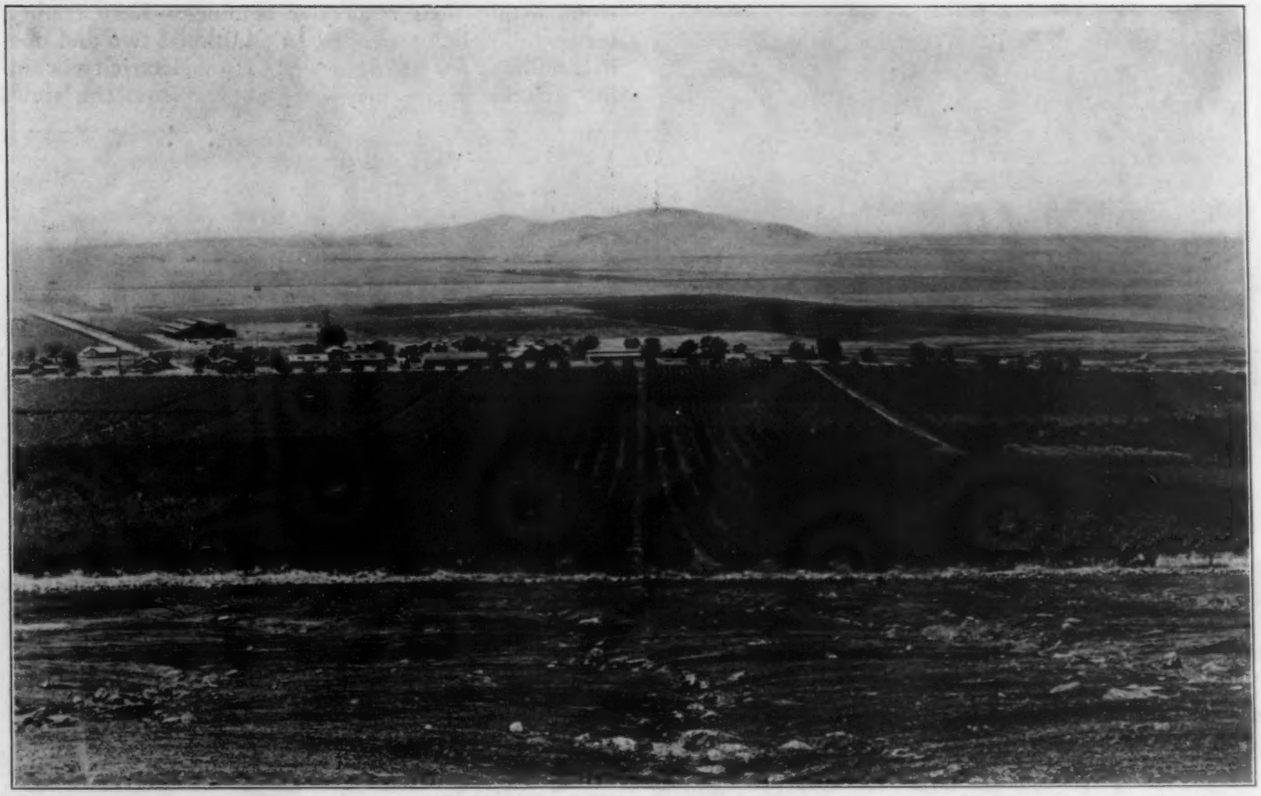
Not only does electricity help to pump the water from the great underground storage of the San Joaquin basin, but it helps to make the pipe through which to conduct it onto the land. An electrically run factory near Henrietta is turning out literally miles of pipe which is to extend through a vast area and bring 50,000 acres of arid land to production.

Plowing Virgin Soil

In Kern county alone, the use of electric pumps made possible the increase of corn acreage from 16,000 in 1916, to 25,000 in 1917; of potatoes from 300 to 1200; wheat and barley acreage in this county have increased 3000 over the year before the war. The stretch of dark soil extending into the distance across the back of the picture shows the new plowed desert ready for the lifegiving water.

Water Pumped by Water Power

The power from the mountain waterfalls furnishes electric energy, then lower in the valleys sinks into the sands to form a great underground reservoir beneath the San Joaquin country. And here, by way of compensation, the electrically driven pumps lift it to the surface and pour it out upon the fertile soil. Perhaps nowhere else in the world is the service of electricity to food production so essential as in this growing Western territory.



THE PROMISE FULFILLED

First a power line out into the desert—in one instance the San Joaquin Light & Power Corporation built 31 miles to connect up 125 horsepower—then a pump and an irrigating system and the first shoots of green—finally, this garden stretch of miles and miles of the most fertile country in the world. The country shown in these two views was originally barren desert land like that on the preceding page. Today, under proper irrigation, it is furnishing hundreds of millions of dollars worth of food products every year. In the steady conquest of the desert, in the phenomenal increase of production made possible by this irrigation, electricity's war service in the interest of agriculture is to be found. And back of all this stands a permanent gain in prosperity for the country—from rich farms the impulse passes on to growing communities, transportation, manufactures, and back to increased needs for electricity in factory and home.

The rock crusher for road building, electrically operated.

WAR SERVICE IN ROAD BUILDING

The out-door transformers for oil pumping and highway construction.

THE great highways, the arteries of California, now world famous as scenic wonders, are today rendering an indisputable service in conveying the products of agriculture and industry to the markets of the world in supplying the needs of the nations at war in defense of democracy.

Thirty-three million dollars have been appropriated by the citizens of the state for the building of these highways. In addition to this, the various counties of the commonwealth have augmented the outlay for further extensions within their respective confines. Kern county, for instance, has expended an additional two and one-half millions for its highways. How electricity is aiding in this service may be gathered from the views

A concrete bridge in Kern County

shown on this page. First, the rock crusher, electrically operated, then the out-door transformer for ready use in the mixing of concrete along the road under construction, and finally the completed highway —a most useful institution in these strenuous times, and yet a joy to the people of the community throughout all posterity.

SOME STATISTICS OF THE WORK

Miles of road surveyed		2280
Miles of Right of Way secured		1705
Acres of Right of Way secured		13327
Miles of Highway constructed:		
Oiled Macadam	129	
Concrete Pavement	933	
Asphalt	33	
Graded	395	
Total		1490

A typical highway in California—a beautiful creation, yet a creation that is rendering eminent war-time service.

AN ALFALFA SHEEP PASTURE

These are the sheep that feed on the alfalfa that is raised on the land that is watered by the help of electrically driven pumps—and the nation is looking to them to furnish a major portion of its food supply. $300,000 worth of lambs and mutton, to say nothing of some $200,000 worth of wool, is the record of one county alone in this particular region.

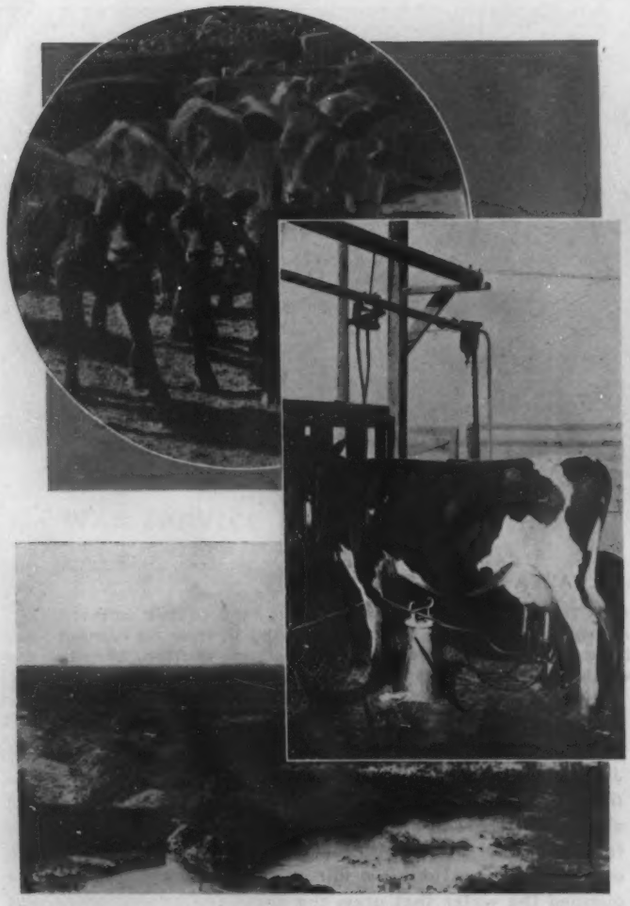
And then electricity provides the power to do the shearing.

PROFIT IN PIGS

Just to show what can be done with pigs on irrigated land—in 1912, a Kern county farmer invested $330 in 12 sows and a boar. At the end of two years, subtracting all expenses for food and labor, his profit was exactly $2032.70, or something over 600 per cent on his original investment. And electricity pumped the water that grew the grain and alfalfa which was fed them. For further particulars on this remarkable industry, the reader is referred to the secretary of the Board of Trade, at Bakersfield, California.

SPINELESS CACTUS FOR FODDER

Perhaps the most natural product for the newly salvaged soil is spineless cactus, which provides excellent fodder for the livestock of the farm.



The cattle are fed on electrically irrigated alfalfa and milked by electricity

IRRIGATION AND THE DAIRY INDUSTRY

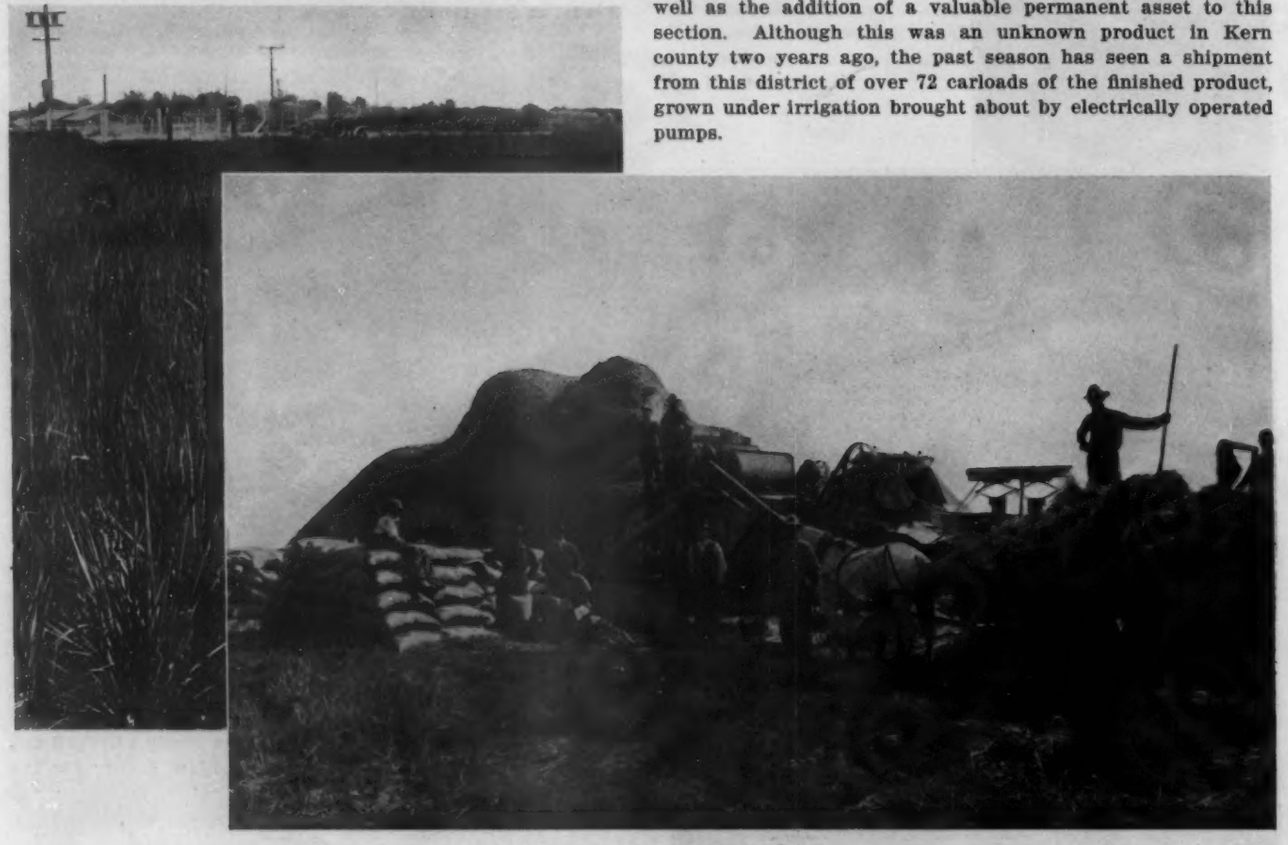
Irrigation has played a most important part in the development of the dairy industry in California, as is shown by the census reports. Electricity in the pumping of water, the milking of cows and many other uses about the farm, is becoming indispensable. Many of the now leading dairy counties in the State were twenty-five years ago immense wheat fields, but with the coming of irrigation and intensive agriculture this condition has been materially changed. Statistics for 1917 are not yet available, but a glance at the two previous years will give an indication of its value to the commonwealth in the statement below setting forth the counties of the state that have produced over one million pounds of butter fat per year.

Counties—	1915	1916
Butte	1,124,710	2,073,297
Fresno	3,158,220	4,204,416
Glenn	1,258,020	1,725,746
Humboldt*	5,591,870	5,588,604
Imperial	6,334,316	6,780,552
Kings	3,811,477	3,960,949
Marin	2,338,338	2,475,329
Merced	4,253,000	4,028,062
Sacramento	1,737,511	1,422,051
San Joaquin	1,184,658	1,618,455
San Luis Obispo	2,759,751	2,303,547
Sonoma*	2,965,893	3,071,474
Stanislaus	9,973,320	9,980,021
Sutter	969,594	1,048,270
Tulare	4,787,690	4,677,839
Yolo	1,091,496	1,241,083

*Non-irrigated.

RICE FROM THE SAN JOAQUIN VALLEY

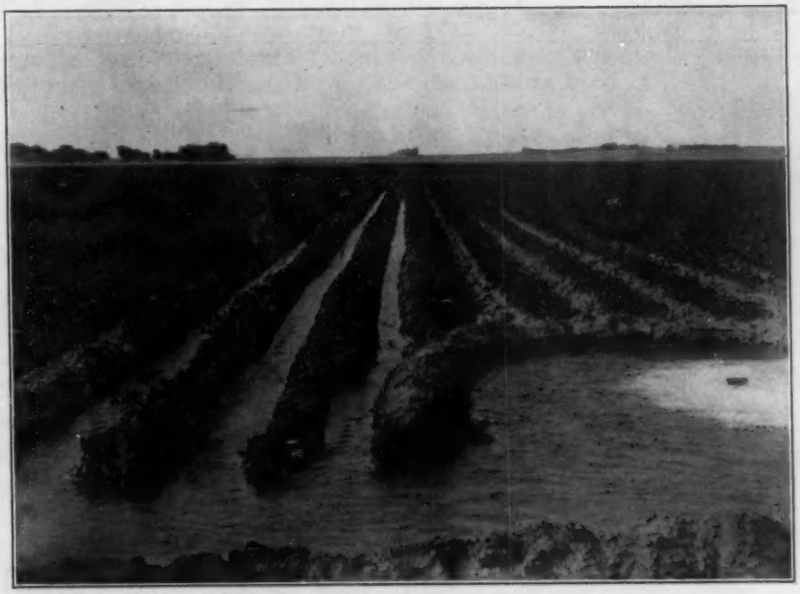
Here is a new agricultural war industry of California—the raising of rice. For this purpose land absolutely unavailable for anything else, often subject to alkali, is used to a great extent. The flat lands of Tulare county offer new and promising opportunities for war service of this nature, as well as the addition of a valuable permanent asset to this section. Although this was an unknown product in Kern county two years ago, the past season has seen a shipment from this district of over 72 carloads of the finished product, grown under irrigation brought about by electrically operated pumps.



The new rice fields of California

FODDER CORN

The first year after irrigation produces a bumper crop of corn or alfalfa or potatoes, as the case may be. Some 37,000 bushels of corn and an equal amount of kaffir corn and maize were grown in 1916 in Fresno county — and the year of war demand has brought an increase of something like 50 per cent in acreage.



MILES OF POTATOES

$151.40 was realized from every acre of this vast potato field and then the ground was ready for the next crop. Some five crops of alfalfa are obtained in a year as well as double crops of many other food products. The maintenance of this vast area at full production capacity is one of the constructive services of the war.

THE CORCORAN GRAIN WAREHOUSE

Carloads of war service in much-needed grain, all from irrigated farms where water is pumped electrically from Lake Tulare, formerly the second largest fresh water lake in the United States, but today gradually receding due to intensive use of its water in irrigation.

Deciduous fruits in the harvesting

Grapes and Raisins

The power lines of the San Joaquin Light & Power Company serve 80% of the grape and raisin industry of California. On the other hand, California is the most important factor in viticulture in the United States. It has over 90,000,000 vines, more than all the rest of the states in the Union. It represents an investment of $150,000,000, which returns an annual income to the grower of over $20,000,000. Over 100,000 people are dependent upon California's viticultural industry. This includes 15,000 heads of families that own vineyards, 700 wine-makers, and the laborers who do the picking and hauling, besides those employed in the wineries and those engaged in cultivating and handling our raisin and table grapes.

Preparing for the making of "Sun-Kist" raisins

Deciduous Fruits

Deciduous fruits — apricots, peaches, pears, plums — are of increasing importance as food stuffs for war service. In 1917 California produced $173,000,000 in orchard products, as compared with $130,-5000,000 in 1916.

The soil of the immense agricultural district served by the San Joaquin Light & Power Corporation is as varied as its production. It is a well-accepted fact that arid and semi-arid lands are rich in plant food. The chemical elements have not been washed out by excessive rains and the soil has been aerated by a long series of cloudless summers. Throw up the soil a short distance below the surface and it is found to be productive at once. It does not have to be "weathered" as in the cold and rainy regions.

Drying the product for war foodstuffs

WAR SERVICE OF ELECTRICAL ENERGY IN THE MINES

The mineral output of California for the year just closed amounted to a valuation of $173,000,000, as opposed to $127,901,610 in 1916. In the district served by the San Joaquin Light & Power Corporation the enormous production of crude petroleum is of marked value at this period. The war service of electrical energy in the oil fields is tersely summarized in the four concluding pages of this article. At this point it is well to acquaint the reader with some of the other products of the mines in order to form a proper value of their importance for war service.

In the illustration below is shown the mining district of Randsburg, where tungsten deposits are mined —a product that is of great value in munitions manufacture. Some five millions of dollars in tungsten ores were mined in California during the past year.

Tungsten mining was active in several districts, especially in Kern and Inyo. The discovery of a large tungsten belt near Bishop attracted much attention that culminated in the development of several excellent producers and the erection of four plants.

The outstanding feature of the year was the intensified search for chrome, manganese, platinum and the rarer metals. Never before has the seeking been so determined or carefully conducted. High prices, brought about by the war, stimulated prospecting for minerals previously considered hardly worth the hunting. Rejuvenation of hundreds of old-time producers and discovery of new metal yielders in all sections of the state insures a tremendously increased output in 1918, particularly copper, silver, lead, zinc, quicksilver, many of the rare metals, and possibly gold. And in all this intensive search for new metals electricity is now recognized as an important aid.

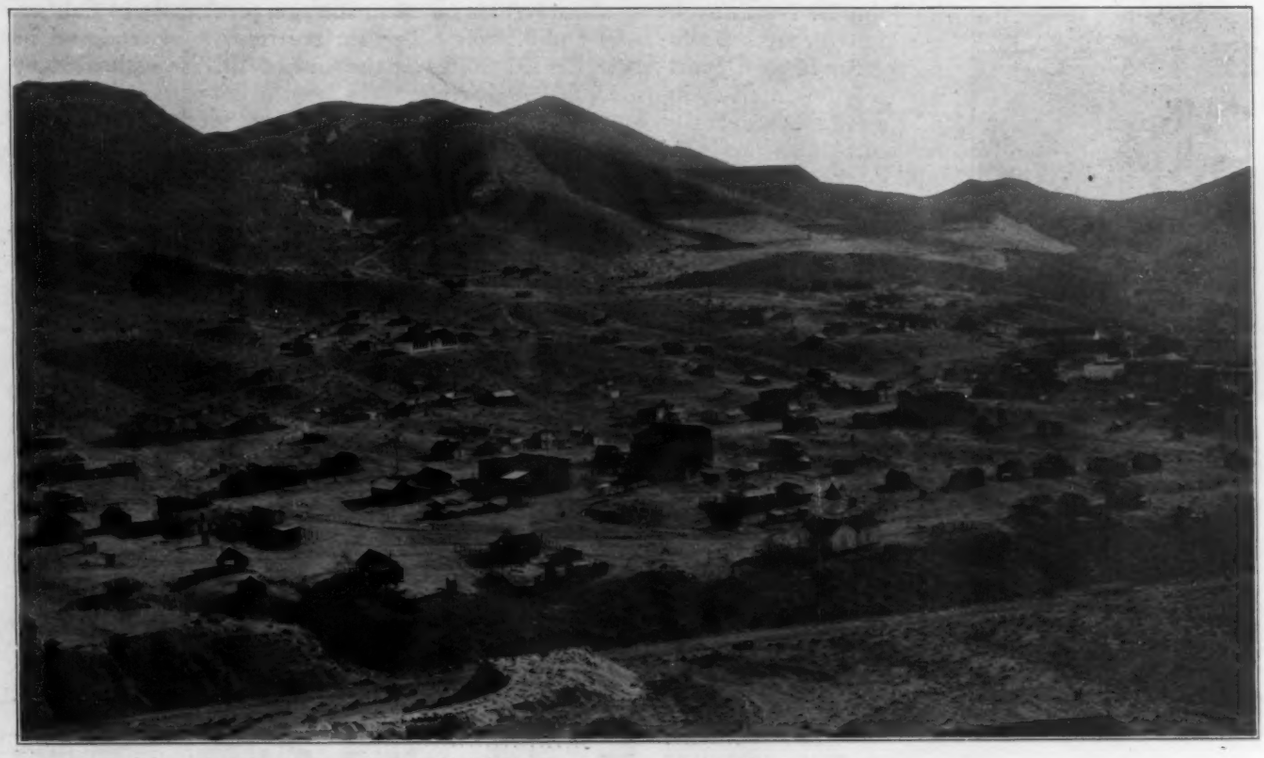
California is still the premier state in gold production and the electrically operated gold dredge has during the past year advanced to high planes of efficiency, breaking all records established in other commonwealths of the United States. Her production of gold for 1917 was about twenty-two million dollars. The gold dredges operated in the district served by the San Joaquin Light & Power Corporation continued their accustomed yield for the year.

The gold production for California, since its discovery in 1848, has amounted to a billion and two-thirds dollars. In recent years the electrically operated dredge has produced the major portion of the output. Here is the yearly production for the past ten years:

1907	$16,727,920
1908	18,761,559
1909	20,237,870
1910	19,715,440
1911	19,738,908
1912	19,713,478
1913	20,406,958
1914	20,653,496
1915	22,442,296
1916	21,410,741

Value of Other Mineral Products

Substance—	1915	1916
Borax	$1,663,521	$1,670,000
Brick	1,678,756	1,600,000
Cement	6,044,950	6,100,000
Clay — Pottery	133,724	135,000
Lead	225,426	1,000,000
Lime	286,304	285,000
Limestone	156,288	155,000
Magnesite	283,461	800,000
Mineral water	467,738	470,000
Natural gas	1,706,480	1,800,000
Pyrite	293,148	295,000
Quicksilver	1,157,449	2,500,000
Salt	368,737	350,000
Silver	851,129	1,400,000
Stone, miscellaneous	5,011,108	5,100,000
Zinc	1,617,383	2,000,000



The tungsten mines at Randsburg

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PANORAMIC VIEW OF THE

1—Standard Oil Company reservoir farm on plains just to left of picture. Derricks in distance are discovery wells in the new west front territory of the Kern River field now being opened up by the Standard and Associated Oil Companies.

2—Headquarters Standard Oil Company pipe line division. This is starting point of pipe line which carries oil from this field to Point Richmond refinery.

3—Standard Oil Company earthen reservoirs.

4—Standard Oil Company, Bakersfield district refinery.

5—Standard Oil Company steel tank farm.

6—Producers' Transportation Company headquarters, pipe line station and reservoirs—beginning of pipe line handling oil for Union Oil Company and Independent Oil Producers Agency. Terminal, Port San Luis.

7—Union Oil Company refinery recently destroyed by fire. Now in process of rebuilding and will be electrically equipped and operated throughout.

8—Associated Pipe Line Company station, beginning of line terminating at Port Costa.

9—Oil Center, location of field headquarters of Associated Oil Company. Main field offices, shops and residences.

10—Railroad loading racks for transportation of oil.

11—Headquarters and main field offices of Kern River Oilfields, Limited, the English corporation which purchased properties of 33 and Imperial Oil Companies.

12—Headquarters and field offices Kern Trading and Oil Company, now known as Fuel Oil Department, Southern Pacific Company.

13—Headquarters and field offices The Petroleum Development Company, oil producing department of the Santa Fe Railway System.

14—Location of original discovery well just around bend in river.

PRODUCTION OF FUEL OIL

Not a Victrola record, but one of the power plant district managers looking through a pipe in the oil fields.

PRELIMINARY estimates by John D. Northrop of the United States Geological Survey, Department of the Interior, indicate that the quantity of petroleum produced and marketed in the oil fields of the United States in 1917 reached the record-breaking total of 341,800,000 barrels, a quantity nearly 14 per cent greater than the former record output of 300,767,158 barrels, established in 1916. California's fields were the second largest of all sources

The production is apportioned among the major fields as follows:

Field—	Barrels. 1916	Barrels. 1917
Appalachian	23,009,455	24,600,000
Lima-Indiana	3,905,003	3,500,000
Illinois	17,714,235	15,900,000
Oklahoma-Kansas	115,809,792	147,000,000
Central and N. Texas	9,303,005	11,000,000
North Louisiana	11,821,642	8,700,000
Gulf Coast	21,768,096	24,900,000
Rocky Mountain	6,476,289	9,200,000
California	90,951,936	97,000,000
Other Fields	7,705	.....
Totals	300,767,158	341,800,000

The salient features of the industry in 1917 were the record levels reached and firmly maintained by prices of crude oil at the wells and the enormous demand which absorbed not only the current output of the wells, but necessitated a net draft of about 21,000,000 barrels on oil in storage, principally in California and Illinois. The surface reserve of crude oil in the United States at the end of 1917 is estimated at 153,000,000 barrels.

The principal sources of new production in 1917 were Estill county, Ky.; Butler county, Kan.; Carter county, Okla.; Wichita and Harris counties, Texas; Converse county, Wyo.; and Los Angeles county, Cal.

Petroleum comes fourth in the West, according to these statistics, as a most valuable asset in natural wealth of the nation. But the salient feature of wartime service in the oil fields is the vast increase in the use of hydro-electric energy in the drilling of new wells and in the pumping of the oil itself.

In past years California's production has been as follows:

Year	Barrels	Year	Barrels
1875	175,000	1898	2,249,088
1876	12,000	1899	2,677,875
1877	13,000	1900	4,319,950
1878	15,227	1901	7,710,315
1879	19,858	1902	14,356,910
1880	40,552	1903	24,340,839
1881	99,862	1904	29,736,003
1882	128,636	1905	34,275,701
1883	142,857	1906	32,624,000
1884	262,000	1907	40,311,171
1885	325,000	1908	48,306,910
1886	377,145	1909	58,191,723
1887	678,572	1910	77,697,568
1888	690,333	1911	84,648,157
1889	303,200	1912	89,689,250
1890	307,360	1913	98,494,532
1891	323,600	1914	102,881,90
1892	385,049	1915	91,146,620
1893	470,179	1916	90,262,557
1894	783,078	1917	97,000,000
1895	1,245,339		
1896	1,257,780	Total	1,040,888,292
1897	1,911,569		

10. 11. 12. 16. 13. 14. 17

KERN OIL FIELDS

15—Catch basin for holding waste oil and water to prevent same from flowing into Kern River, waters of which are used for irrigating hundreds of thousands of acres of agricultural lands. Tremendous damage would result were oil to get into the river and be carried onto lower farming lands.

16—Another catch basin.

17—China Grade, the county road leading into the oilfield over the bluffs—one of the main traveled highways.

18—Southern Pacific Company branch railway line serving the oilfield just to rear of picture.

THE GROWTH OF NEW INDUSTRIES

Along with all the increase in agricultural production set forth in the preceding pages, the advent of hydroelectric service has also seen the building of many new industries. To care for the agricultural product alone an empirical formula seems to have developed whereby it may be roughly estimated that for every horsepower of installation in the rural community for agricultural purposes, at least one-third as much power springs up in new manufactories to care for this product—manufactories consisting of dairying, fruit preserving, rice threshing, canneries and the like. Not alone is this section growing industrially due to this cause, however, for recent statistics show that the freedom of country life and environment for the workers is leading the larger industrial centers to consider with ever increasing favorable light the establishing of future extensions in such districts as are being built up under conditions of ideal service and open-air life, such as those presented in the San Joaquin Valley.

But the major industry of this section is to be found in the oil fields which are now being so rapidly changed over to electrical operation. As to how this increasing electrical load,

A LAKEVIEW GUSHER

The electrical pumping of oil is but one of the modern methods of economy which are helping to preserve the store. A 10,000 "barrels daily" gusher was tapped recently by the Standard Oil Company, and not a drop lost.

which today consists of over 2000 wells electrically operated, is rendering a war service in the saving of oil that would otherwise be consumed in the pumping of this product, the reader will find conclusive evidence by scanning the pictures and noting the emphatic points brought out.

War Service in the Pumping of Oil

Electricity in the oil fields saves men, material, and fuel—three essentials in helping to meet the present international crisis. Considerable investigation into comparative costs of oil-well pumping by various methods has been undertaken during recent months, the results of which show very favorably for the method electrical. S. G. Gassaway, in the General Electric Review for August, 1917, makes a detailed comparison of pumping by electric motors, when power is purchased at 1 cent per kw. hr., electric motors with power generated by steam turbines, gas engines, electric motors with power generated by gas engines and steam engines at wells, including boiler plants burning oil. After careful analysis for a given installation, the following figures are given:

Cost of Oil Well Pumping

	Cost Equipment at Wells.	Cost Power Sta. Equipment.	Yearly Operating Cost.
Electric motors, power purchased at 1 cent kilowatt hour	$60,900.00	.....	$43,707.00
Electric motors, power generated by steam turbines	60,900.00	$58,800.00	49,647.00
Gas engines	85,500.00	.....	53,265.00
Electric motors, power generated by gas engines	60,900.00	74,500.00	58,879.00
Steam engines at wells, including boiler plants burning oil	69,800.00	.....	152,182.00

Thus it is seen that the electric drive is far superior from a financial viewpoint.

There are something over 2000 electrically operated oil wells that have been operating for periods of from 1 to 11 years, in which the repair expense has not equalled 1 per cent of the first cost. Likewise, there are several hundred gas engine wells which have operated not more than 4 or 5 years, in which the maintenance exceeds 11 per cent.

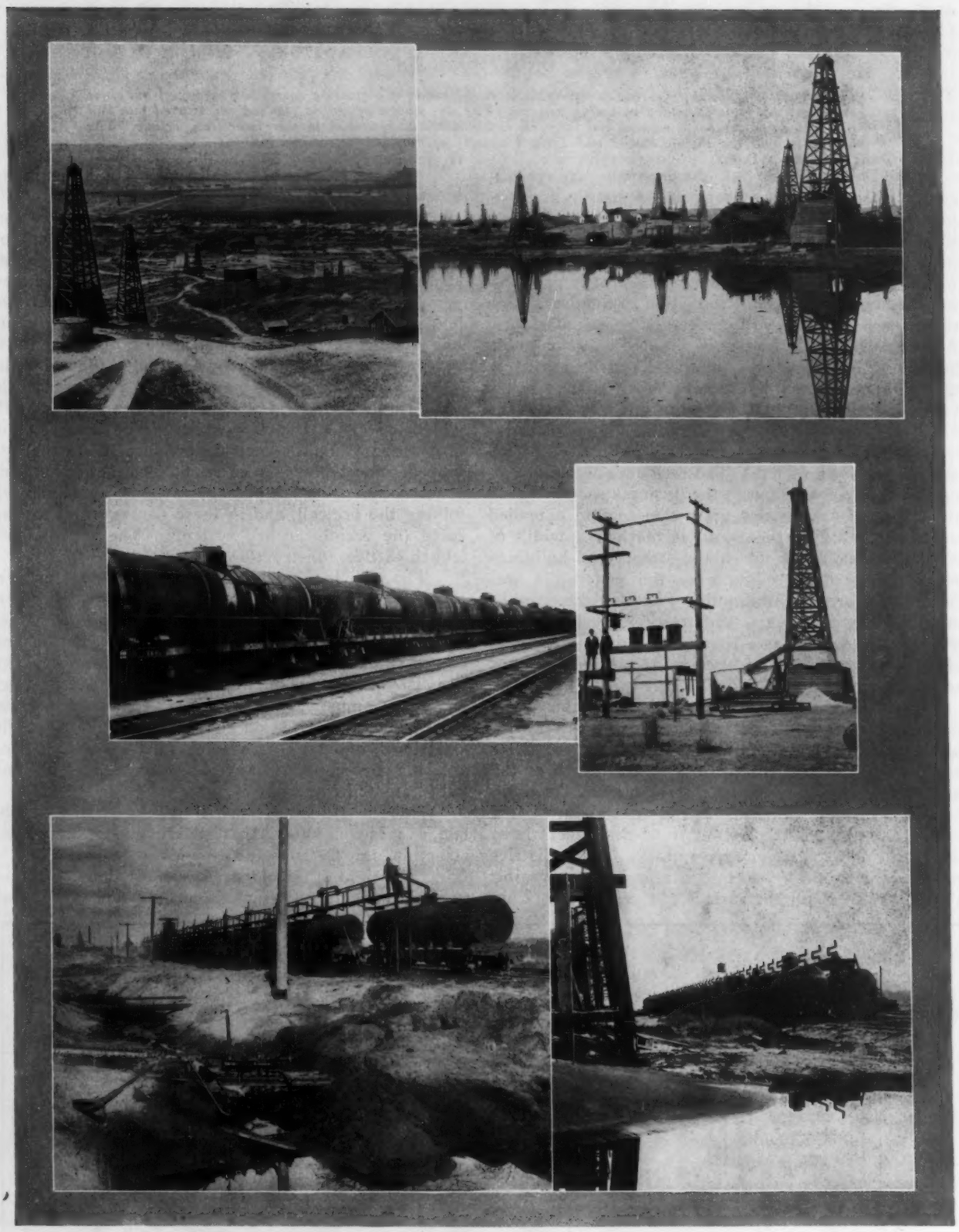
When electric motors were first put in the oil fields the designing engineers had many problems to solve. Today, however, an excellent design has been put forth that meets admirably the unusual conditions experienced in this type of installation.

A decided advantage in motor drive for the pumping of oil is the very steady motion imparted to the beam and in the fact that the number of strokes when once set on the controller will remain the same year in and year out until the controller is set at some other speed. The motor does not pick up the rods with a jerk, as in the case of steam and gas engines, the speed of the band-wheel being practically constant for the entire revolution. The rods, therefore, are less liable to crystallize with resulting breakage, causing shutdown due to rod troubles.

But best of all, the real war-time service that electrical energy is today rendering in the oil fields is the fact that the oil product itself, so needed in driving our merchant marine and in other fields of industry, is thus replaced by that subtle force electricity, generated from a never-failing source—the snow-clad Sierras a hundred miles away.

THE USE OF NATURAL GAS IN ELECTRIC GENERATION

Where steam-electric generation has been necessary as an auxiliary to hydro-electric generation, fuel oil is used exclusively in California for this purpose. The San Joaquin Light & Power Corporation however, is planning to initiate a new war service in the conservation of fuel oil, by the early introduction of natural gas as a fuel for its steam electric plant at Barkersfield, California. Assuming that a barrel of oil generates on the average of 170 kw. hr. of electric energy, it is estimated that the season of 1918 will see a saving of over a hundred thousand barrels of oil from this source alone. To accomplish this, six hundred million cubic feet of natural gas will be required—gas that is now being put to no useful purpose in the oil fields. Such service as this is true conservation.



WAR SERVICE IN THE OIL FIELDS

By a close examination of the several views shown above, one may conceive some idea as to how California's 97,000,000 barrels of crude petroleum were last year moved to market. First, the oil is taken from its natural haunts below the earth's surface by means of pumps operating within the derricks shown in the first view, which is that of Taft, California. Next, the oil product is taken from the temporary lakes created from the output of the pumps, and either loaded into cars or in storage tanks. Electricity serves in all these operations, and in one of the views given the reader will note the out-door transformer station serving the oil well to the right. The various methods shown above indicate only one means of transportation. The largest part of the oil, however, is pumped directly to the seaports through pipe lines which are being operated at the present time to the full capacity, to facilitate railroads in coping with car shortage.

ASTORIA UNDERGROUND ELECTRICAL SYSTEM

BY R. J. DAVIDSON

(To prevent the unsightly wiring necessary to meet the needs of a growing community, many of our cities are requiring underground distributing systems. The way such a system is planned and carried out, and the difficulties overcome without too large an expenditure, is described in this interesting article. The author is with the Pacfic Power and Light Company of Portland, Ore.—The Editor.)

The Pacific Power & Light Company has recently completed an underground electrical distributing system for power and lighting service at Astoria, Oregon, that is somewhat out of the ordinary, due to the unique street construction.

A brief resume of the conditions obtaining at Astoria is not amiss as an introduction to the description of the system. The present estimated population of Astoria is 17,000. The city is situated on a tongue of land lying between the Columbia River on the north and Young's River on the south, with the principal residence section and all of the business section on the north side and facing the Columbia River. A ridge runs the length of the peninsula with rather a steep slope up from the north. The residence section occupies this hillside and forces the business section to the river front. As the city grew this section extended out further and further until it reached a width of about four blocks in which the streets and buildings were supported on piling over the water. It was necessary to replace this piling and also the planked streets every few years, and it soon became an expensive foundation for a business district. There was also the inconvenience of having no basement space or sewerage system.

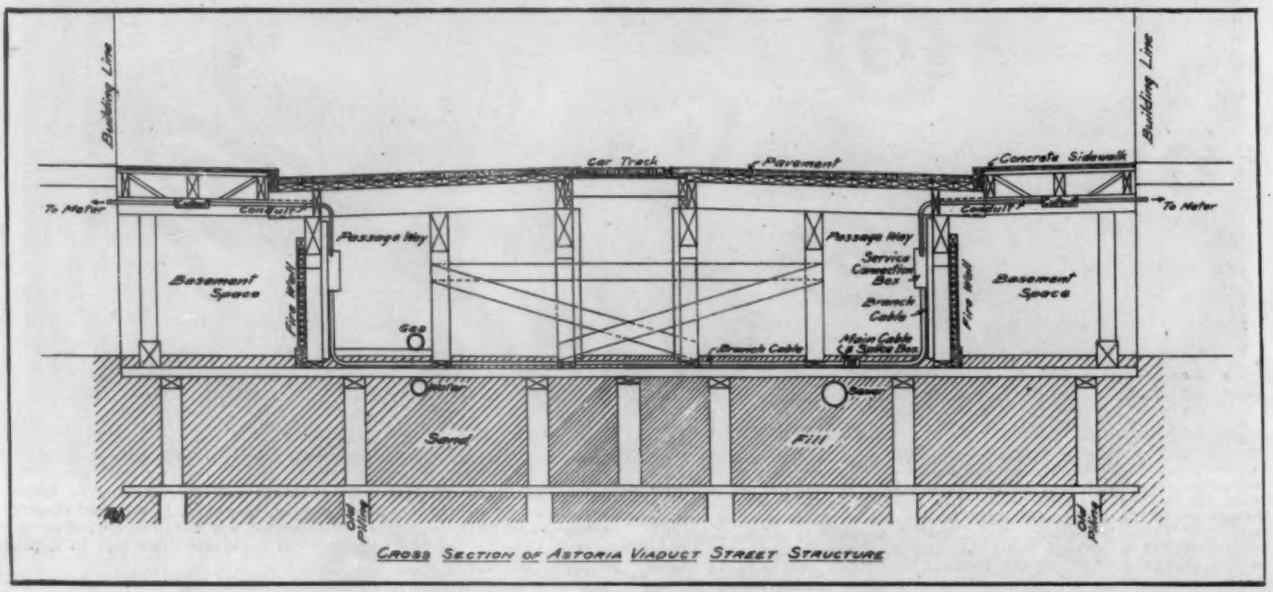
Early in 1914 the city created a Sanitary and Reclamation Commission, with power to better conditions. A rock sea wall was built along the outer edge of the business district the entire length of the water front, and sand was pumped in from the river, making a fill under the business district about 11 feet in depth and extending some two or three feet above the high tide level. The street grades in this district were raised about 4½ feet to a new level averaging about 9½ feet above the surface of the sand fill. This necessitated raising practically every building in the business district.

The accompanying sketch shows a cross section of the completed street. The old piling was cut off below the surface of the sand fill and, with caps and stringers, constitutes the foundation for the street-supporting structure. Eight rows of posts run the length of the street. The rows nearest the property line support the sidewalks and have no bracing to interfere with the basement space under the sidewalk. The next adjoining rows have bracing running lengthwise of the street, and along these rows run tile walls which are called the "fire-walls." The four rows of posts supporting the central portion of the street are braced among themselves in both directions. This construction allows a passageway on either side adjoining the firewall, and in these passageways are located the various utility systems. The approximate length of this construction is one mile.

The city installed the sewerage and water systems, which are buried in the sand, one on either side of the street. The telegraph and telephone companies installed their circuits with bracket construction and cables supported from the viaduct framework. The gas distributing system, installed by the Pacific Power & Light Company, is ideal in that the mains are not buried but are carried on supports slightly above the sand level, and all connections, valves, services, etc., are in plain sight. Coated and wrapped steel pipe with patented couplings are used.

The electric system presented the greatest problem, as it is well known that underground electric construction quickly runs into money.

The height of the old street surface above the solid ground made it necessary to use 60-foot to 70-foot



CROSS SECTION OF ASTORIA VIADUCT STREET STRUCTURE

poles for supporting the electric light and power circuits. As a consequence, practically all of the lines were routed through the main streets where the heaviest loads were located, and, as the city grew, the number of wires increased until there was a veritable network of overhead construction, and to this, of course, was added the telephone company's overhead system. The city decided that, with the other street improvements, the wires should be placed underground to insure a more sightly business district. The layout finally approved by the city permitted overhead construction on the cross streets, running north and south, provided all circuits were removed from the main thoroughfares, running east and west. This made it possible to eliminate primary and arc circuits from the underground system. Conforming to this plan, the main overhead primary feeders were re-routed to an east and west street paralleling the business district and branch overhead primary lines were carried down the north and south streets to transformer poles which were located about 30 feet back from the interesection with the main east and west business streets. These poles were made the point of entrance for the underground secondary cables.

A thorough study was made of the load conditions and the underground system was designed to handle not only the present loads but any normal increase for a number of years to come. As it was necessary to provide both lighting and three-phase power service, a four-conductor cable was selected. This cable is paper insulated, lead sheathed, and protected by two layers of spiral steel tape and jute servings. The secondary leads of the transformers are connected to the underground cable through four-conductor potheads mounted on cross-arms. The cables extend down the poles to the level of the sand fill, being protected by galvanized iron conduit from the sand level to a point about ten feet above the sidewalk. From the bases of the poles the cables are buried in the sand, about one foot beneath the surface, without conduit, duct or other protection. As this sand is only a few feet above the high tide level, it is more or less damp at all times, and should serve as an excellent means of conducting the heat away from the cables. The district fed from each controller bank, which consists of two transformers connected in open delta, extends from middle of block to middle of block. The arrangement provides two cables for each district, both running from the transformers along the north and south streets to the intersection with the east and west streets, where they turn in opposite directions and extend to the middle of the block. This allows the lighting loads to be divided evenly between the two transformers. At the middle of the block the cables from each direction terminate in a connection or sectionalizing box which consists of a watertight compartment in which are two sets of four contact jaws each, to which the conductors are connected; removable blades serve to connect the two districts, which are normally left separated. The purpose of this connection box is to insure quick resumption of service in case of transformer burnout, or other failure, in either district, and to bank the transformers in multiple in the event of heavy overload on one district.

The customers' services are not connected directly to the main cables, but lateral, or branch cables, are tapped off approximately every hundred feet through splice boxes which are filled with solid compound. These branch cables run to either side of the street, where they rise to service connection boxes mounted on the fire wall. These service connection boxes are made of sheet iron, similar to a cabinet box, and each one contains a lead pot-head, in which the branch cable terminates, and a slate connection panel on which are mounted four copper current studs. The customers' services enter the top of this box through conduit and are directly connected to the current studs. This box is sealed and is not opened except for connects or disconnects. It is intended that the customers' services should extend through the fire wall at the property line nearest the service connection box, as this allows two buildings to be served without an extensive service run, but where there is more than one building to a lot it is sometimes necessary to run conduit from the service connection box along the fire wall to the building line. Just beyond the fire wall, on the property side, the service enters a fused cutout switch, mounted in an iron box, which is used as the main entrance fuse and emergency cutout in case of fire. The point of division in ownership of equipment is at the fire wall, the company owning all that portion of the service on the street side, and the customer all on the property side. The company's requirements, however, demand that all inside wiring be enclosed in conduit to the meter. As there is more or less vibration of the viaduct timbers, due to traffic, it was decided that no meters should be mounted on any of the street supporting structure.

While the system has been in operation but a short time, no important defects have developed, and there is every reason to believe that it will be a very satisfactory and economical installation, conditions of service considered.

HYDRO-ELECTRIC DEVELOPMENT IN FRANCE

Many of the available sources of hydro-electric power in France have not yet been developed—a situation which is today being met by the French government as a war measure.

Questions relating to the utilization of the power of non-navigable rivers and streams in France have been transferred for the period of the war from the Ministry of Agriculture to the Ministry of Munitions, according to the London Electrical Review. The Minister of Agriculture has stated to the French Parliament that plants rated at 400,000 horsepower have been established or are in course of construction in the Alps, the Pyrenees and central France. He also said that the generating stations were under agreement to supply for a number of years after the war a certain proportion of the energy generated at a cheap rate. Several of the plants in question were in connection with factories making explosives with a calcium carbide base. With the cessation of hostilities, it would not be difficult to convert such plants to cyanamide manufacture, which would be of great benefit to French agriculture.

CONSTITUTION AND BY-LAWS

THE SAN FRANCISCO ELECTRICAL DEVELOPMENT LEAGUE

(Much study is being given in various quarters of the West to the building up of meeting places in the larger communities where men of the electrical industry, irrespective of their affiliations with the Institute, the N. E. L. A., the Jovians, the electrical contractor associations, power company or jobbers' organization, may meet to discuss matters of common concern. Here is a proposed new constitution for the San Francisco Electrical Development League, that should prove of interest throughout the West in view of this present day need.—The Editor.)

ARTICLE I

Name

Section 1. The name of this organization shall be The San Francisco Electrical Development League.

ARTICLE II

Objects

Section 1. To encourage a more extensive use of electricity and to generally promote the welfare of the electrical industry.

(a) By urging the adoption of durable and efficient devices and apparatus and the safe and proper installation of the same.

(b) By the promotion of friendliness and good-fellowship between those engaged in the various sections of the industry.

(c) By concerted action through lectures, papers and discussions educate consumers in the application of electric current to their needs.

(d) By acting in a spirit of co-operation with similar organizations in the United States of America and in countries bordering the Pacific Ocean, to promote standarization of commerce and industrial practice in international relations.

ARTICLE III

Membership

Section 1. The membership of this organization shall not be limited in number, it being desired that it include all white male persons resident in or near the City of San Francisco, California, engaged in the electrical or allied industries.

Sec. 2. How Attained—Each application for membership must be in writing, signed by each applicant and endorsed by two members in good standing. Each application shall be filed with the Membership Committee, which shall investigate the applicant's qualifications, and if satisfactory for membership, so endorse the application and refer it to the Executive Committee. The Executive Committee shall pass upon each application separately, their action shall be secret and it shall require four affirmative votes for election to membership.

ARTICLE IV

Officers and Their Duties

Section 1. There shall be a President, First Vice-President, Second Vice-President, and Secretary-Treasurer and four elective members of an Executive Committee of eight, which shall be the governing body of the League, four of whom shall constitute a quorum.

Sec. 2. The President, First Vice-President, Second Vice-President and Secretary-Treasurer shall by virtue of their office be members of this committee, the other four being chosen by vote at the regular election.

Sec. 3. The term for which all officers shall serve shall be from the 1st of October to the 1st of March, and from the 1st of March to the 1st of October respectively, or until their successors are elected or appointed.

Sec. 4. The President shall preside at all meetings of this organization and of the Executive Committee.

Sec. 5. The First Vice-President shall preside at all meetings and perform the duties of the President in his absence.

Sec. 6. The Secretary-Treasurer shall keep minutes of all business meetings of this organization and of the Executive Committee, and perform such other duties as pertain to his office and are assigned to him by the President and Executive Committee. He shall collect all dues and have charge of all funds of this organization and shall deposit same in a bank selected by the Executive Committee. He shall not pay out money of this organization except by check bearing his signature and the counter-signature of the President or of the First Vice-President. He shall keep accurate account of all receipts and disbursements entered in books, the property of this League, which shall at all times be open to the inspection of the Executive Committee, and which shall be audited monthly by the Finance Committee. He shall in the discretion of the Executive Committee be required to furnish an adequate bond.

Sec. 7. The Executive Committee shall be subject to call at any time by the President, the Vice-Presidents, and Secretary-Treasurer. They shall pass upon applications for membership and act as the controlling and governing body of this organization. They shall direct the affairs of this League, the appropriation of its funds, and shall have the authority to cancel the membership of any member for cause deemed sufficient to them.

ARTICLE V

Meetings and Elections

Section 1. Regular meetings of this League shall be held on Wednesday of each week, except during the months of July and August (non-working months). Notice of meetings shall be sent to each member by the Secretary-Treasurer not less than twenty-four hours prior to such meetings. These meetings shall be held between the hours of twelve noon and two p. m. The second meeting of each month shall be known as the regular business meeting, and insofar as possible all business shall be transacted at that meeting.

Sec. 2. At the business meeting of the League held in the months of September and February, officers and members of the Executive Committee shall be elected by ballot. The first election under this constitution shall be in February, 1918. Prior to the meeting of the League held in the months of September and February, the President will appoint a Nominating Committee of five members, whose duty it shall be to submit a report at the election business meetings in September and February, respectively, report to name one or more members whom they recommend be placed in nomination for each of the offices to be filled at that election.

Sec. 3. Special meetings may be called at any time by the President or three members of the Executive Committee.

ARTICLE VI.

Initiation and Dues

Section 1. The initiation fee shall be two dollars. The dues will be fifty cents per month, payable semi-annually, in advance.

Sec. 2. If the dues of any member are not paid within fifteen days from date at which they become due, he shall be notified by the Secretary, that he is in arrears, and if not paid within fifteen days from the date of such notice, he shall be liable to suspension.

ARTICLE VII

Committees

Section 1. The committees of this League shall consist of two classes, Standing and Special.

Sec. 2. Members of standing committees shall hold office during the President's period of office, or until their successors are appointed. Members of special committees shall hold office until discharged from further service by the President and Executive Committee.

Sec. 3. All committees shall be appointed by the President and the Executive Committee.

Sec. 4. The standing committees shall be as follows:

(a) Public Policy Committee, whose duties shall be to take part in any movement or legislation that has a bearing upon the electrical industry. To inspire legislation that will correct evils such as exist in the present laws affecting electric signs, inspection, fire hazards, the establishment of a fire limit, and cognant matters.

(b) Visiting and Relief Committee, whose duties shall be to visit members of this League who are ill, and to render to such every possible service. To investigate the case of any member who is otherwise distressed and upon finding him worthy to report his case to the President for such action as may be deemed wise and practicable.

(c) Reception and Attendance Committee, whose duties shall be to see that new members and visitors are introduced at our meetings and are made welcome, and also endeavor to perform a like service for those members whose acquaintance is limited. This committee shall also stimulate attendance at all meetings.

(d) Publicity Committee, whose duties shall be to see that an advance notice of all meetings is printed in the local press. To see that full reports of all meetings and all activities of this League are furnished to all local publications and to all electrical papers, together with such photographs as are obtainable. This committee shall also prepare the notices of meetings.

(e) Finance Committee, whose duties shall be to devise ways and means for raising funds sufficient to meet any deficit arising in the finances of this organization, and for raising such other funds as indicated by the Executive Committee. Once each month the Finance Committee shall audit the books of the Secretary-Treasurer, and report the results of such audit to the Executive Committee.

(f) Entertainment Committee, whose duties shall be to provide suitable speakers and other entertainment for meetings of the League in accordance with authorization given by the Executive Committee.

(g) Membership Committee, whose duties shall be to endeavor to increase the Active Membership of this League to the maximum number of desirable eligibles.

Sec. 5. The Executive Committee shall have the right to name standing committees in addition to those indicated in the preceding section.

Sec. 6. Each committee shall report through its chairman to the Executive Committee not less than once in each month, and shall be at all times under the guidance and direction of the Executive Committee.

Sec. 7.

(a) The Executive Committee shall have the right to remove any member of any committee for reasons deemed by it sufficient, and to appoint another member to fill the vacancy so created.

(b) The Executive Committee shall also select a member to fill any vacancy which may occur within it.

ARTICLE VIII

In all cases pertaining to parliamentary practice not covered in this Constitution and By-Laws, the rules contained in "Roberts' Rules of Order" shall govern this organization and its meetings.

ARTICLE IX

Amendment

Amendments to this Constitution and By-Laws may be made and new Articles added thereto only by an affirmative vote of not less than two-thirds of the members present at a regular business meeting of the League and then only provided that such amendment or addition shall have been presented in writing to a previous regular meeting of this League, and a copy of same shall have been mailed by the Secretary-Treasurer to each member of this League not less than ten days prior to the meeting at which the amendment or addition shall be passed.

TESTS OF BUILDING COLUMNS

Two fire tests of building columns are being made each week at Underwriters' Laboratories, under Associated Factory Mutual Fire Insurance Companies, the National Board of Fire Underwriters, and the Federal Bureau of Standards.

The apparatus used in the tests consists of a gas furnace capable of being controlled according to a specified standard temperature curve, reaching a maximum of 2300 degrees F. (1260 degrees C.), at the end of an eight-hour test. The load on the columns while being subjected to fire test is supplied by means of a hydraulic ram, an average load of 100,000 pounds being maintained during the test, this being calculated for the various sections according to accepted formulas for working load.

The temperature of the column furnace is measured by means of platinum and base metal thermo-couples, supported in porcelain tubes at two elevations; and that of the columns, by means of base metal thermo-couples attached to the metal of the column at four elevations and at different points in the section. The temperature indications are read with a potentiometer indicator and connections are also made to an automatic potentiometer recorder, so that graphic records can be obtained, if desired, of the indications of any set of couples.

The vertical compression and expansion of the columns, due to the load and heat, are measured over a gauge length of 37 inches in the upper half of the column by means of wires attached to the column at each end of the gauge length, the other ends being weighted and passed over an idler at a point outside of the furnace and as far from the column as room conditions will permit. The wires are protected inside and outside of the furnace by suitable insulating and protecting tubes. Readings of vertical movement are taken at intermediate points on the wires by means of microscopes mounted in micrometer slides, the true movement at the column being calculated from the distance relations of the microscopes and the fixed end of the wire, with reference to the point of attachment to the column. The lateral deflection of the column is measured by means of readings on scales placed perpendicular to and parallel with the wires.

A view of the testing furnace and accessories, with a column ready for test, is shown herewith.

The tests are continued to a breakdown of the sample, and hence no inferences as to the comparative merits of the various column designs and column coverings should be drawn from the illustrations, which show simply the effect of load and fire on a number of samples which have been subjected to test. The time required to obtain failure varies with the type of material and thickness of covering, the periods for the columns so far tested ranging from 17 minutes for the unprotected column to over eight hours for the heavier types of protection.

ELECTRIC COOKING

A recent article in the London Electrical Review gives facts and figures as to the application of electricity in large kitchens such as those of institutions. The comparison of actual costs showed that the difference in the initial cost is not so much with an installation of coal, gas, and steam, as with gas alone, but it would be impossible to use gas apparatus only on some of the installations, owing to the restricted space. The first cost is not the only cost to be considered, and should never be looked upon as the predominant factor.

When the working comparisons are considered, electricity has the advantage in almost every detail, the following being a few of the essential items which in the majority of cases, when carefully gone into, offer sufficient advantages to outweigh any difference in capital cost.

1. Cleanliness and absence of fumes.

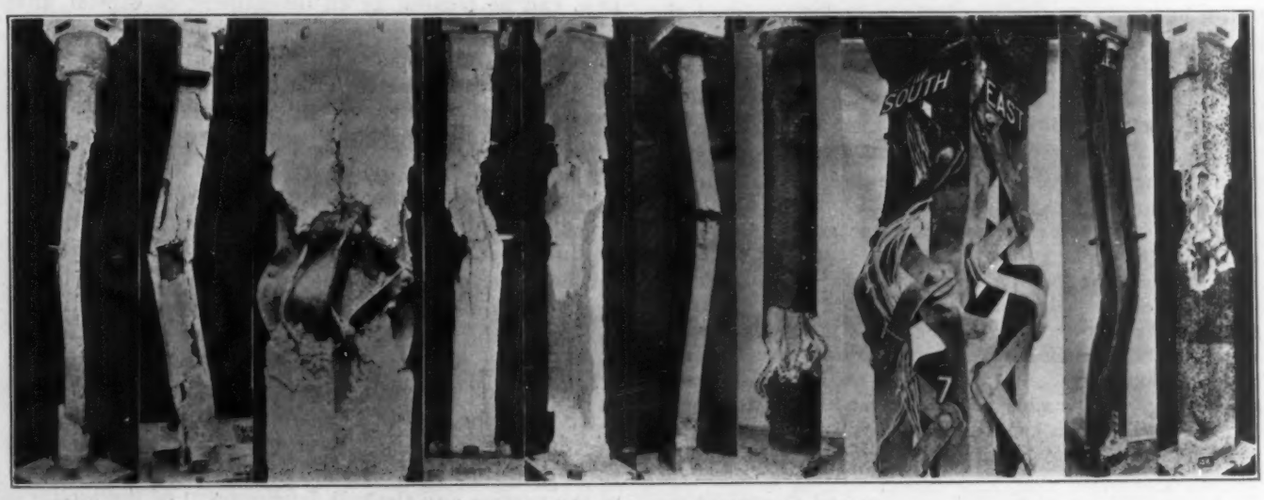
2. Constant heating value, also the facility of reducing the heat to a definite degree, which is impossible with either coal, gas, or steam.

3. Reduced labor costs as compared with coal or steam.

4. Less floor space required, owing to the fact that electrical apparatus can be installed in almost any position, and in some cases mounted on tables or one above the other. Less floor space means less rent.

5. Economy in food, owing to less shrinkage of meat and less waste of food.

6. Saving on the renewal of kitchen utensils.



The result of fire tests of building columns

CURRENT RATE FIXING PROBLEMS

BY C. E. GRUNSKY

(The determination of the allowance to make for "going value" offers perhaps the greatest difficulties met with in the establishing of public utility rates. It does not seem proper to set a premium on a man's mistakes by basing it upon cost of development, nor can it be left solely to the judgment of the expert. That this intangible value should bear some fixed and arbitrary relation to a year's earnings is coming to be recognized by valuation engineers. The author is a pioneer in the field of valuation problems.—The Editor.)

GOING VALUE AS AN ELEMENT IN FIXING PUBLIC UTILITY RATES

Referring to going value as an element deserving consideration when "value" and rate-base are treated as synonymous the standing Master in Chancery, Mr. H. M. Wright, in his recent report (August, 1917) on the value of the properties of the Spring Valley Water Company*, says:

"Such additional value, if it is to be recognized here, is obviously not of a separate element in the plant, as is a conduit or a reservoir, but of the plant as a whole; an intangible value, a characteristic of the unified business structure, inhering in every part. We are here concerned, however, to estimate this value, if possible, as if it were a separate thing."

"Going value and development expense are not synonymous. One is value; the other is cost, either actual, where the form of value is actual investment in plant, or hypothetical, or reproduced, where the present valuation is by present market value, or reproduction cost."

That there is always difficulty in estimating "going value" for inclusion in the rate-base is clear from this general statement and has been universally recognized. The Master quotes Judge W. W. Morrow, who in Bonbright vs. Geary (D. C. Ariz. 1903) 210 Fed. 44, 54, 56, in an opinion awarding a preliminary injunction, said that a going value should be allowed but that, though often presented to him, he had never been able to determine a proper amount upon the evidence submitted. He quotes Judge W. C. Van Fleet of the District Court of Appeals, San Francisco as saying:

"All that we are agreed upon is that upon principle there should be a greater value attachable to a going concern than one which is merely in its initiative and not enjoying the benefit of patronage."

The law as interpreted by the courts requires that value be made the basis of the calculation when the sufficiency of the charges for service or for the output of a public utility is in question, and it is for this reason that the embarrassment plainly evidenced by these quotations has resulted.

In the Spring Valley rate case already referred to the Master refers to the difficulty of determining going value when he says:

"It is the intangible nature of the going value which makes it difficult to prove. * * * A large part of the aggregate wealth of the world is intangible, without separate market value or ascertainable reproduction cost. In Adams Express Company vs. Ohio, 166 U. S. 185, the Supreme Court sustained the taxation of an express company upon an assessment of property largely in excess of the value of tangible property. The intangible property is at one place ascribed to franchises, and in another to good will; the name is not important."

*Spring Valley Water Co. vs. City and County of San Francisco (rate case).

Justice Brewer, in delivering the opinion of the Supreme Court in this case, uses the following language in discussing intangible property:

"To say that there can be no such intangible property, that it is something of no value, is to insult the common intelligence of every man. * * This is eminently a practical age; courts must recognize things as they are and as possessing a value which is accorded to them in the market of the world."

In the light of such opinions by our highest tribunals, universal recognition of the fact that a business may have going value is to be expected. Whether or not it is logical or wise to include such value in the rate-base of a public utility is another question elsewhere considered.

How can this value be measured? This is the problem for immediate consideration and it may as well be stated at the outset that no acceptable solution thereof has yet been offered.

In comparing two business enterprises alike in all respects except that the one already enjoys a fully developed business while the other has just emerged from the construction stage and is about to begin operation, a difference in value is readily recognized, and the appraiser of the first, which is already a going concern, would naturally be inclined to take the view that the advantage which it has over the second can be measured by the cost of developing the business and that this cost in the absence of other satisfactory standards may be accepted as an index of the "going value."

This appears so plausible that many economists and engineers have adopted a procedure based on this reasoning for estimating going value. They have recognized, however, that while cost of developing business can be treated as an investment of capital, that it would not always be fair to accept the actual cost in each individual case as representing a proper allowance in the rate-base for cost of development. If this were done it would be equivalent to placing a premium upon inefficiency because the actual cost of development would naturally be greatest in the case of the property which has been least efficiently managed. To obviate this difficulty recourse has been had to the reproduction method with an attempt to visualize and estimate the cost of development which would be incurred if under present day conditions a plant had to be reproduced. In the application of this method of determining the advantage expressed in terms of money which the going concern has over another exactly the same, and in the same market, but with business not yet established, it is necessary to assume that some definite time will elapse between the completion of the system and the full development of the business as commanded by the concern whose "going value" is

to be appraised. It does not seem to the writer any simpler or more satisfactory to thus, on the judgment of the expert, make an assumption of the time that would be required to establish a business than it would be on the basis of actual experience in the same line of business, in the locality involved and elsewhere, to form an opinion as to what would be a proper allowance for the cost of development.

In any business which is already established, an analysis may be desirable of the various elements that make up the intangible values of the property. In such cases some such procedure as that of estimating the cost of re-establishing the business under present day conditions may be of service in segregating "going value." But when earnings are to result from rates yet to be fixed the case is somewhat different, and the question will arise whether the relation between cost of development actual or hypothetical, however ascertained, is a safe guide to the going value which should be created by the profits of the business in excess of interest on the invested capital.

Intangible values of whatsoever nature result from high earnings. They include not only "going value," but also in some cases water-right values and whatever may be included in such terms as "franchise value," "good will," and the like. Such values do not exist unless the rates are higher, as the writer has elsewhere pointed out they should be, than would produce net earnings equaling the return ordinarily expected from money loaned for use in similar enterprises.

The difficulty of using a hypothetical reproduction of an existing utility property, as a means of estimating the cost of developing the business, is apparent from the following consideration. The comparative plant is assumed to be exact reproduction of the existing plant. There is no competition between the two plants. It might be assumed that the moment that the comparative plant is completed, it will be in full service at the same earning power as the established plant. There would then be no appreciable development period. If such a period is admitted it implies a lack of completion of the comparative plant or the development period should be measured only by the time that it would take the consumer to put himself in position to avail himself of the service. The market in such a comparison is assumed to be at hand. The expert who resorts to this method of estimating going value will give his judgment wide latitude, as his conclusions are not apt to be convincing.

It is well to bear in mind, however, that if a community which is served by a public utility had undertaken the establishment of this utility as a public enterprise it would have been subject to the same and perhaps greater costs in developing the local business than the costs which were incurred by the owner of the property. The losses in the early years, on the same chances that there would be loss, would have confronted the public as it confronted the private enterprise. The cost of establishing business is, therefore, an element apart and while perhaps in some measure and under a multiplication of facts relating to many enterprises, the cost of establishing may be some guide to what the normal going value should be, it will be more logical to treat this cost either as a part of the capital legitimately in the enterprise, or taking the other extreme, as a business loss to be amortized out of earnings within a reasonable time.

While the cost of establishing the business, including early losses and expenditures for unsuccessful work are not a direct measure of going value, they are, nevertheless, in so far as they were legitimate, of that class of expenditures which should, as already stated, come back to the owner of the property sooner or later. The mere knowledge that this is the case, or the probability that the owner will some time recover them, adds value to the property. To add them in the exact amount shown by the cost records in any particular case would not, invariably, be a fair procedure. The owner who builds with care and under the best expert advice, and who pushes his work forward as rapidly as the market to be served will justify, and who enters immediately upon a profitable business without any lean years, is entitled to a reward for his able management and the success of his enterprise. The "going concern value" of a plant constructed under such favorable circumstances is as great as the "going concern value" of other plants of a similar character but burdened perhaps with large expenditures for unsuccessful work and for the development of business.

The combined experience of all utilities of similar character should in the long run establish the addition which should be made to the earnings, either to amortize a fair allowance for this class of expenditures in a reasonable time or to provide an adequate return thereon if treated as investment or as an increment of the value of the going concern. In the light of this conclusion it would not be fair in the individual case to treat all losses during lean years and all unproductive expenditures during the constructive period, such as water tunnels or wells that produce no water, structures that fail during erection, damage by fire and flood, earthquake or war, as additions to value or as additions to a rate-base. These are losses and if occurring after operation has commenced are naturally treated as the reverse of earnings. They cannot with propriety be added to the valuation of the physical properties, though it may be eminently proper on account thereof to estimate the cost of reproduction liberally. In some form they should be taken into account in fixing rates. It is rarely practicable to determine such losses and unproductive expenditures with accuracy. These expenditures and losses may be large and yet they should ordinarily be assumed to have been incurred under competent advice. It should generally be assumed, in other words, that it could not be foreseen that what turned out to be unproductive work would have no value. The easy way to deal with such expenditures is to add them to the rate-base valuation, giving them a name and treating them as a measure, in part at least, of intangible values. While this may appear reasonable when the amount involved is small, or not beyond what the sum of human experience would seem to indicate as fair, the other case can readily be foreseen, as already explained, in which this would not be so. To lay down a rule that actual losses whether during construction or in the early years of operation, are to be treated as elements of value is never logical.

It should be noted, too, that there is a clear distinction to be made between the expenses ordinarily

classed as "overhead" and "development cost." The overhead expense is an expense incurred during construction and is naturally and logically made a part of the cost of construction. The development cost is an additional outlay during operation, which is necessary to maintain and operate the property during the time when the receipts for commodity furnished or for service rendered are insufficient to meet operating expenses and a fair interest return on the invested capital.

It is apparent from what has above been stated that "going value" and the value of physical elements are elements apart; between which, in other words, there is no definite relation. "Going value" then is not dependent upon the capital which is invested in any property. And yet "going value" grows with the business enterprise. It is subject to appreciation. This suggests that when once the going value is determined which efficiently managed enterprises of various kinds should ordinarily have, this value can be brought into some relation to the volume of business. This thought has heretofore been advanced by the writer and by others who are contending that it would be fair to allow a going value about equal to one year's income to be created by adequate earnings. On this point Mr. Leonard Metcalf, a consulting engineer of large experience in valuation matters, in the recent Spring Valley Water Company rate case, said:

"In terms of gross annual revenue, development expense is found to be approximately equal to one year's gross revenue as of the date of valuation, in the case of ordinary waterworks properties of medium and small size, and between one and one and one-quarter times the gross annual revenue in the case of the larger properties—the cumulative interest during construction charges incident to the long period of construction involved in the building of the larger works being accountable for the difference."

Bearing on this same subject the writer in a paper read in 1912 before the American Society of Civil Engineers, said:

"The most logical course to be pursued, and the one which is always open to the appraiser" (rate-fixing authority) "is to use the best available means for determining the amount of capital which is properly invested, then to determine what the earnings should be to yield an ordinary return on the investment thus ascertained, and then to increase these earnings by an arbitrary" (reasonable) "amount, which may vary within wide limits, not only to compensate for past losses and for the hazard during construction and operation, but also as a compensation for management." And again: "Any addition to the rate of return * * * * if there is certainty that it will be earned, is the real basis for the intangible values as they would be taken into consideration by a purchaser."

Along the same line of reasoning Mr. Allen Hazen, also of the highest standing among consulting engineers who have devoted attention to valuation matters, in the rate case already referred to, says:

"When a business is established and going and earning a certain revenue, it is normally worth to the investor what that income amounts to, capitalized on a rate of return on other investments of equal security, and that the rate of return is normally less than the amount which a company has to have the chance of earning, if it can, in order to induce capital to go into an enterprise of that kind; in other words, if you want to build the Calaveras works, and you want people to put their money into the enterprise on a chance of earning some rate of return without any guarantee that they will earn it—simply on a chance—we have to make that chance 7 per cent, we will say. Now, when the Calaveras works are built, and if the enterprise is successful and it earns that 7 per cent on what it has cost, and is established, then the man on the street will capitalize that income at 6 per cent and the plant is worth one-sixth more than it cost."

The Master in Chancery in this case upon reviewing the testimony of Mr. Hazen, of which the above is but a brief extract, then goes on to show what going value would be created if various rates of return appropriate for a going plant and a like plant ready to begin business were assumed. It is with some satisfaction that the writer makes note of these facts and of the endeavors by others to lay a basis in the earnings for "going value," because they confirm his conclusions that this basis lies there and that the result of the capitalization of the earnings should not make its appearance in the rate-base. (See preceding articles.)

May we not conclude then, that in the case of the public utility which is subject to regulation, its intangible values arise from some allowance in the earnings, in excess by some predetermined amount of the earnings, which would just yield a proper rate of interest on the actual capital reasonably and properly invested. When the sum of all intangible values is thus determined (by capitalization of a part of the earnings) it will matter little what name is used to designate them. But the increment of earnings in excess of the ordinary interest rate on investments, in safe going concerns, should be so fixed to cover also any amortization made necessary by obsolescence, or loss by fortuitous events, and to cover whatever allowance is to be made as compensation for management and as a share in general prosperity, possibly in lieu of appreciation. When the limitation of this excess by rate fixing authorities is under consideration, it can probably be more nearly standardized by bringing it into some definite relation to volume of business, than in any other way.*

*See "Public Utility Rates and the Volume of Business," Journal of Electricity, Vol. XXXIX, No. 10, page 450.

POWER PLANT FARTHEST NORTH

A 45-kilowatt hydro-electric plant for light and power in the town of Chitina, Alaska, has just been put in operation. It was built by the owners, O. W. and M. S. Nelson, has been under construction for two years and represents an outlay of $22,000, making it probably the highest price per kilowatt plant in the world. One of its distinctive features is that it is the farthest north of any year-round hydro-electric plant on the continent. Adjacent to the town of Chitina is a three-acre lake which is fed by a number of springs of such mildness that the lake does not freeze to any considerable depth even in the coldest weather. This lake is 100 feet obove the Copper river and separated from it by a ridge. By driving a 1400-foot tunnel through this ridge the water from the lake is carried over to the Copper river side, where it is dropped down a hundred feet through 270 feet of 16-inch steel pipe. The tunnel was driven through 900 feet of frozen earth and loose rock and through 500 feet of extremely hard solid rock. The earth and rock were thawed with steam points.

BUSINESS BUILDING
SELLING IDEAS
DISPLAY

WITH THE ELECTRICAL CONTRACTOR AND DEALER

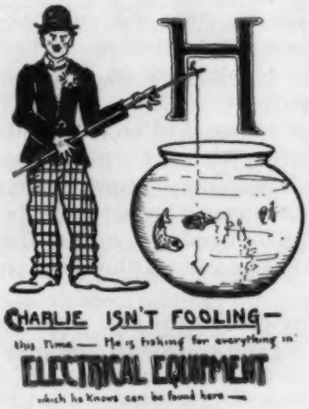
CONSTRUCTION KINKS
COST KEEPING
ESTIMATING

NOVEL ELECTRIC WINDOW MOVIE DISPLAYS

BY ERNEST A. DENCH

(Suppose it were some other man's window advertising say, tea-kettles—would you stop and look at it? Probably you would if it were one of the window displays suggested here. What is more, you would remember where you saw it, and would be more than likely to go in and ask about it. The idea is not an expensive one, but utilizes the appeal of the movie to the moving-picture fan. The author is a well-known writer on moving-picture subjects.—The Editor.)

Photoplay Scenes in Your Window



A WINDOW DISPLAY
If you wonder what this has to do with an electric shop, so will the customer, and he will remember the display.

HAVE you noticed how effectively the enterprising photo-play exhibitor uses photographs, or stills, as they are called in the studio, of scenes from forthcoming attractions for lobby display purposes? How about adapting the idea to a window display of your own? These photographs attract a good deal of attention and serve as an appetizer for the production in question. But you will be cheating yourself if you permit the exhibitor to attract all the publicity, relying upon people stopping to look in your windows as sufficient recompense. It is, therefore, up to you to run only pictures relating in some way to the electric industry. Suppose one of the scenes shows an electric company's showrooms with the hero in charge. The star's press agent may have circulated a story to the effect that the player spent several days in an electric company's showrooms, learning the business.

"Making the Movies" (Macmillan) is a book full of anecdotes concerning the players and the making of photoplays which can be done over to fit in with the pictures you obtain from the local exhibitor.

Stage Settings in Your Window

The flat white screen is fast disappearing from the motion-picture theatre. The modern exhibitor prefers to enclose it in an artistic stage setting of a permanent character, with special lighting and color effects.

This suggests possibilities, one of which has already been capitalized by an exhibitor in co-operation with an electric company. The exhibitor supplied the florist with a miniature model of his stage setting for window display purposes. In the setting were costumed dolls to represent the principal actors appearing in photoplays at the theatre in question. The dolls are changed with every new program and passers-by stop to admire the clever miniature models of the stars.

If you desire to carry out this stunt, why not inaugurate a contest for the best dressed-up doll of Mary Pickford, or any other favorite they may care to choose.

Another plan involving less trouble and expense is to purchase a Charlie Chaplin statue for about 50 cents. Place it in the window, attach a tiny fishing rod to his arm and place the rod in a goldfish bowl. Below the whole, display a card, worded somewhat as follows:

MARY PICKFORD
The picture carries an electrical advertisement

> **"Charlie is not fooling** this time. He is fishing for everything in electrical equipment, which he knows he can obtain here."

The "Props" Window

"Props" in motion-pictures are not always what they seem. Fix up a display with the following description:

> **"When the movie villain** brings down an electric lamp on the hero's head, he is not hurt, as he pretends to be. The lamp is only papier-mache. This may be all right for 'reel' purposes, but for real use you want lamps that will give good service. We sell such kind."

Co-operative Lobby Displays

The motion-picture theatre's window is the lobby display. Many exhibitors deem a few photographs sufficient; others differ. The enterprising manager devises all kinds of stunts for a feature production, from dressing up wax models to represent certain characters, to making the entrance look like the approach to Hades. What kind of exhibitors do you have in your town? Are they partial to out-of-the-ordinary displays? If so, they are your friends, for they will need your co-operation every now and then.

An exhibitor of my acquaintance wished to have a model kitchen installed in his lobby. He asked the local electric company for the loan of an electric stove. The electric company agreed, on the understanding that a card be displayed, as follows:

"**Stove** loaned by the Blank Electric Company."

And it is worth while recording that the electric company did more business while the lobby display was on exhibition.

Capitalizing the Thirst for Movie Information

The popularity of the motion picture is not a fad—it is as deeply rooted as a sturdy tree, and, like one, will continue to gain in strength from year to year. The collecting of photographs by the fans is only equaled by their thirst for information on movie subjects. It pays to appease it, however insignificant your efforts may appear alongside those of the producers, exhibitors and publishers.

Why not incorporate some photoplay material in your newspaper announcements? What about your showrooms window? That is a dandy place for announcements, while you can place a bulletin board outside your showrooms. When putting over a house-to-house circularizing or mailing stunt, why not head the sheet as though it were a motion-picture publication? It will at least ensure same being read. Think, too, what valuable ammunition it would prove if distributed to movie theatre patrons.

Ten or fifteen cents occasionally invested in a copy of a motion-picture trade journal will yield more than sufficient material for your purpose. As it is news, there is no copyright.

Playing Up Your Service

Your employees may be as perfect as they can possibly be, yet some unreasonable client is apt to complain with absolutely no reasons for so doing. Here is an extract from an interview I recently had with Lillian Walker, the screen favorite:

"In acting business roles, what has impressed me most is the scant consideration some customers show to those who strive their best to please them. So, whenever I enter a store, I endeavor to get the clerk's viewpoint, for if I give him a chance, he will surely please me."

Have a sign painter execute a sign for your window display. Leave space in the middle for Miss Walker's photograph. Head the card: "LILLIAN WALKER SAYS——." Follow on with her remarks, and then, in large, bold letters, conclude like this:

"**Have you ever tried** acting upon Lillian Walker's advice?"

The Movie Star Photo Ad.

Patrons of a down-town photoplay theatre pausing to look in the window of the local electric company's showrooms, were greeted with the following announcement:

"**Free! Come in** and get your favorite movie star's picture. You can collect hundreds of different ones."

Surrounded by the card were small pictures (about a third the size of a postal card) of the various screen idols. Those who went in for a picture without making a purchase carried a permanent advertisement of the electric company, for the blank space on the back was utilized to this good purpose.

The electric company, of course, had an added advantage in that their stunt appealed to photoplay fans at the right moment, but it need prove no deterrent in your case should the nearest movie show be located many blocks away. The dyed-in-the-wool fan (and their number is legion) even carries the fever to bed with him.

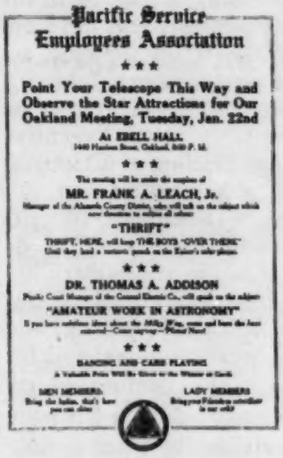
Another electric company divides the cost of these photographs with the leading down-town photoplay exhibitor. They announce in their window:

"**You can see these stars** in photoplays at the Ideal Theatre. But your favorite's picture may be had for the asking."

Night illumination in Utah is not prohibited by the Fuel Administration, for electricity is hydro-electrically generated. The effective flood lighting of the new Latter Day Saints church offices is one of the features of the city. Eighteen G. E. type "L 1" flood lighting projectors are mounted across the street, some two hundred feet distant. The installation was made by Eardley Brothers of Salt Lake City.

Western Ideas

AN ATTRACTIVE INVITATION card is half the secret of a successful meeting. This interesting meeting notice was gotten out by the Pacific Service Employees' Association, an organization composed of members of the Pacific Gas & Electric Company, but it provides interesting reading for anyone interested in getting up similar meetings or special gatherings.


Pacific Service Employees Association

★★★

Point Your Telescope This Way and Observe the Star Attractions for Our Oakland Meeting, Tuesday, Jan. 22nd

At EBELL HALL

★★★

MR. FRANK A. LEACH, Jr.

"THRIFT"

★★★

DR. THOMAS A. ADDISON

"AMATEUR WORK IN ASTRONOMY"

★★★

DANCING AND CARD PLAYING

MEN MEMBERS

LADY MEMBERS

It is not necessary always to be formal in your invitations

Imagine yourself invited to your contractor-dealer's meeting in similar style. The "star" attractions for this astronomical gathering would at least catch your eye, particularly that subject which has "eclipsed" all others. and which threatens to land a "meteoric" punch on the Kaiser's "solar" plexus. Even the most serious evening isn't hurt by a little fun, and occasionally a gathering in lighter mood, with opportunity for socially getting acquainted, provides the basis for better feeling in the regular business of an association. If you haven't had a meeting which promises to be at least as entertaining, "planet" now.

HINTS FOR FAIR EXHIBITORS have been gotten out by one of the large jobbing and manufacturing concerns which should prove of value to the contractor-dealer who is planning to exhibit at the state or local fair:

1. Select your space in pathway of standard attractions, such as a band, university display, etc.

2. It is advisable to exhibit, wherever possible, in an enclosed building to protect apparatus from tampering and bad weather.

3. If Fair officials permit, operation of gas engine pipe exhaust should be put through floor into a post hole at least four feet deep.

4. Where the use of gas engine is not permitted an electric motor of ample capacity should be used and concealed. The engine may be installed over this place to preserve the illusion that the engine is operating the dynamo. Explain "why" to interested visitors.

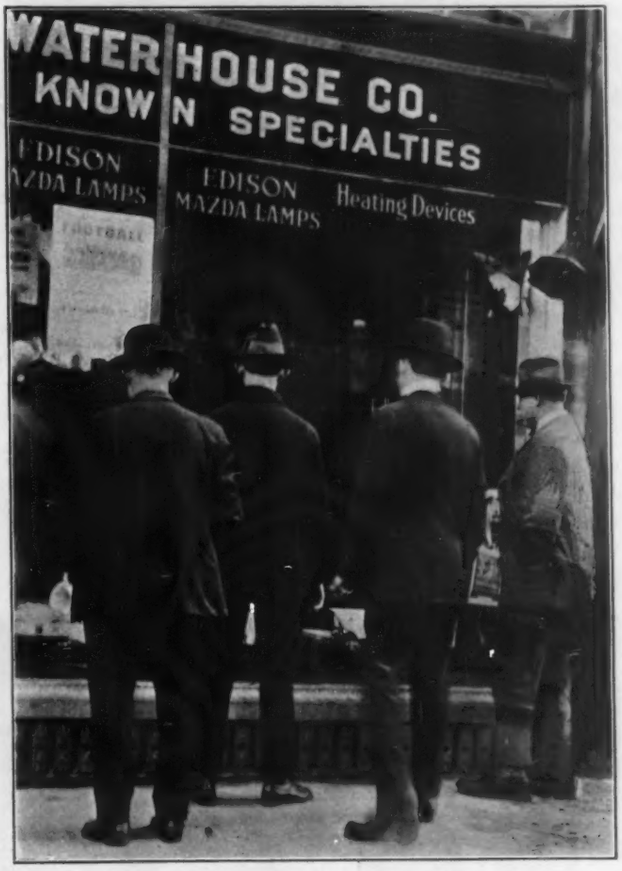
5. If engine is used and a large number of electrical devices are constantly operated, do not keep engine running continuously. It is better to charge batteries several hours daily. An overheated engine makes a bad impression.

6. Use cards to record names of those who evidence an interest. Such names are a valuable asset.

7. Some railroads permit exhibit material to be shipped free of charge back to original shipping point. Get a certificate from secretary of Fair and present it with bill of lading to traffic man who will make adjustment.

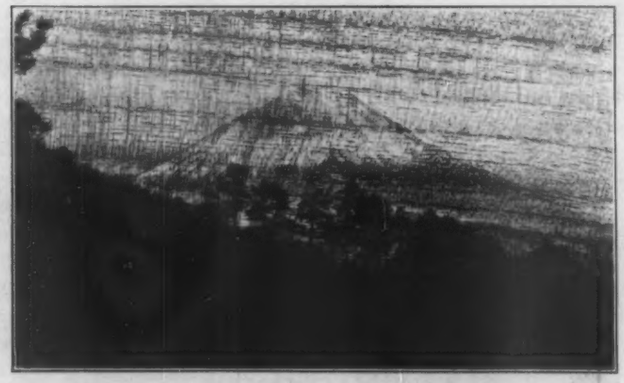
8. AND ADVERTISE, ADVERTISE.

A CROWD GATHERS every half hour to watch the demonstration of Hoover vacuum cleaners which is going on inside this window. The store, which is that of the Waterhouse Company on lower Market street, San Francisco, is well located, with foot passengers continually passing. That is, they continue passing—until they are arrested by the sound of a voice which seems to come mysteriously from above their heads, and the sight of a vacuum cleaner being demonstrated. The demonstrator not only carries out the various operations involved, but at the same time explains to the gathered onlookers the superiorities of the Hoover sweeper. Her voice is transmitted to them through a speaking tube, emerging at the phonograph horn which is here to be seen at the right of the picture. To complete the display, a small transparency toward the front of the window advertises the cleaner, the light which illuminates it flashing off and on periodically. The demonstration has attracted considerable attention, and some of the spectators are likely to be in the position of the Denver woman in the recent campaign for the signing of Food Pledges, who was found to have confused the name of the national food administrator, Herbert C. Hoover, with that of the much advertised electric sweeper.



There is a demonstration going on inside

A WOODEN CARD is the medium upon which this very simple and artistic Japanese landscape has been printed. The use of the thinly shaved wood is most striking and the novelty of the conception lends itself to many further applications. It would be particularly effective in the construction of such advertising matter as calendars, or cards used for distribution purposes. With a pretty picture of slightly different shape printed at the top, a book-mark, bearing the firm name, would be a durable and acceptable reminder.



A Japanese idea which combines novelty with beauty

The card as it stands, perhaps, offers no definite application to the contractor-dealer's business, but it is evidence of the fact that attractiveness in detail pays. The Japanese have carried this into every form of business. If a placard must be placed in the window, it is not a hastily drawn bit of butcher paper, but a thing of beauty in itself, however simple; something which adds rather than detracts from the display grouping.

Inexpensive but effective

WANTED — A TRADE MARK for the California Association of Electrical Contractors and Dealers. A prize of $100 has been offered for a suitable design. The advisory committee handling the California Electrical Co-operative Campaign is desirous of assisting the California Association of Electrical Contractors and Dealers in finding and selecting a suitable trade mark for their organization, and to this end have appropriated $100 to be given as a prize for the most acceptable design submitted to it not later than February 25th. The design must be original, so that it may be copyrighted, and must be acceptable to the executive committee of the California Association of Electrical Contractors and Dealers. It is preferable, but not strictly necessary, that the design should also be suitable for electrical contractors and dealers' associations in other states. It is desired that the trade mark design be such that it might be used on the dealers' stationery, in their newspaper periodical advertising, and also used as signs for window decalcomanias, and for outdoor two-sided metal signs. The committee reserves the right to reject all designs submitted if none prove acceptable, and also to divide the prize money between not more than three, if a combination of features from two or three designs submitted will give the committee a satisfactory trade mark. Designs received showing postmarks later than February 25th will not be considered. Mail your sketches to the "Trade Mark Committee," California Co-operative Campaign, 505 Rialto Building, San Francisco.

A GOOD WINDOW DISPLAY is the special feature of most contractor-dealers' Christmas campaigns, but this pleasing window, which was a feature of the Utah Power & Light Company's Electric Shop this last Christmas, is only one of a series of attractive displays carried throughout the year. In the words of the superintendent, Philip Conley:

"Most merchants think too little of the value of their show windows. Good attractive window trims, always up to date, lend prestige and profit to the store they sell for, and people get the habit of stopping to see what is new, if the windowman makes the most of his job. Mechanical motion and lighting effect, which may be worked into most any electrical goods display add attention compelling power that stops the prospect. The man in charge of this work should be allowed to use his own judgment with regard to expense. When he is instructed to go easy on the display budget, he can always come back with an excuse; but permitted to go 'on his own hook,' he cannot come back, and generally will get better results."

LLOYD'S REGISTER OF SHIPPING—USE OF CABLES IN ELECTRIC LIGHTING ON BOARD VESSELS

(In the present times of active ship building, every contractor should have a full set of wiring rules in his note book. Various rulings used with ships destined for different purposes have been given from time to time in these pages Almost all vessels built for the Allies except French boats, use "Lloyd's Register of Shipping" Wiring Rules, as well as many vessels built for the United States. The following rules governing the use of wire, wire cables and the practice in making joints, form part of this code.—The Editor.)

Leads or Circuits

1. The copper used in all wires or cables should have a conductivity of not less than that of the Engineering Standards Committee's standard, and the wires must be protected by tinning from the sulphur compounds present in the insulating material.

2. The sectional area of the copper wires in the cables should be in proportion to the current carried, and should not be less than as given in Table 1, which is in accordance with the rules of the Institution of Electrical Engineers as revised in April, 1911.

Wire Gauge—Table No. 1

No. of Wires and Gauge in S. W. G. or in inches.	Nominal Sectional Area of Conductors, sq. inches.	Maximum Current Permissible. Amperes.
3—25	.0009	3.7
3—24	.0011	4.5
3—23	.0013	5.3
1—18	.0018	7.2
3—22	.0018	7.2
7—25	.0022	8.6
3—21	.0024	9.5
1—17	.0025	9.8
7—24	.0026	10.4
3—20	.0030	12.0
7—23	.0031	12.4
1—16	.0032	12.9
3—19	.0037	14.8
1—15	.0041	16.3
7—22	.0042	17.0
1—14	.0050	19
3—18	.0053	20
7—21	.0055	21
7—20	.0070	24
7—19	.0086	28
7—18	.0125	34
7—17	.017	40
19—20	.019	43
7—16	.022	46
19—19	.023	47
7—.068 in.	.025	50
7—15	.028	53
19—18	.034	59
7—14	.035	60
19—17	.046	70
7—.097 in.	.050	74
19—.058 in.	.050	74
19—16	.060	83
19—15	.075	97
19—14	.094	113
19—.083 in.	.100	118
37—16	.117	130
19—13	.125	134
37—15	.150	152
19—.101 in.	.150	152
37—14	.182	172
37—.083 in.	.200	184
37—13	.250	214
37—12	.300	240
37—.112 in.	.350	264
61—13	.400	288
61—.097 in.	.450	310
61—12	.500	332
61—.108 in.	.550	357
61—.112 in.	.600	384
61—.118 in.	.650	410
91—.098 in.	.700	434
91—.101 in.	.750	461
91—.108 in.	.800	488
91—.112 in.	.900	540
91—.118 in.	1.000	595
127—.101 in.	1.000	595

The above sizes provide security against undesirable rise in temperature. For long leads larger wires will be required to prevent undue drop of voltage.

3. Except for wiring fittings the sectional area of any copper conductor must not be less than that of No. 18 S. W. G. All copper conductors having a greater sectional area than No. 14 S. W. G. must be stranded.

4. The insulating material must be either vulcanized rubber of the best quality or it must be equally durable.

5. The insulation must be such that when the cables have been immersed in water for 24 hours it will, while still immersed, withstand 1000 volts for half an hour between the conductors and the water.

6. The insulation resistance should not be less than 600 megohms per statute mile at 60 F. after the cables have been immersed in water for 24 hours, the test being made after one minute's electrification at not less than 500 volts and while the cable is still immersed.

Joints

1. Joints in branches, or of branches with leads of small circuits, must be made in properly constructed water-tight junction boxes, or should have the copper wires thoroughly soldered and the insulation carefully carried out, all the joints being made water-tight. Conductors of larger sectional area than 7/18 S. W. G. must be soldered to proper lugs for connection. Joints in flow and return wires should not be made opposite one another. All joints should be in accessible positions, none being made in bunkers, cargo spaces, or spaces which may at any time be used for carrying cargo, stores or baggage.

2. For soldering wires, the fluxes used must not contain acid or other corrosive substances.

3. Where practicable, the leads should be placed where they can always be accessible; if they are laid in wood battens the covers should be screwed on, not nailed, and care should be taken that the casings are so arranged that water will not lodge in them. Cables which are properly covered with protective metal sheathing, or which are protected by galvanized wire armouring, may be unencased. They should, however, be secured by screw clips, not by staples. All sharp bends in cables should be avoided.

4. All cables which are liable to be exposed to the weather or moisture should be lead covered, or be otherwise specially protected. Where great heat is experienced, no wood casing should be used, but the cables should be protected by iron casings, or if they are not exposed to mechanical injury, they may be armoured with galvanized wire and fastened to decks or bulkheads with screwed clips spaced not more than 12 inches apart.

5. If cables are led through cargo spaces, coal bunkers, or spaces which may at any time be used for carrying cargo, stores or baggage, or which are not at all times accessible, they should be strongly protected against damage, preferably by iron casings. If they are led through metal tubes, these must be strongly secured, and should be fitted so that water cannot lodge in them.

Armoured cables may be used without casings or tubes provided they are strongly secured to the under side of decks or to bulkheads by screw clips and provided they are armoured in conformity with the standard of the Engineering Standards Committee, as shown in Table 2.

Armoured Cables—Table No. 2

Diameter of Cable to be armoured measured over lead covering. Above, up to and including.		Single Wire Armouring. Size of Galvanized Wire.	Double Wire Armouring. Size of Galvanized Wire in each layer.	Metal Tape Armouring. Thickness of Metal Tape, two layers to be used.
Inch	Inch	Inch. S. W. G.	Inch. S. W. G.	Inch.
...	.50	.072 No. 15	.056 No. 17	..
.50	.75	.092 No. 13	.072 No. 15	.03
.75	1.00	.104 No. 12	.080 No. 14	.04
1.00	1.25	.116 No. 11	.092 No. 13	.04
1.25	1.50	.128 No. 10	.104 No. 12	.04
1.50	1.75	.144 No. 9	.116 No. 11	.04
1.75	2.00	.160 No. 8	.128 No. 10	.04
2.00	...	.....	.....	.06

6. Where cables pass through beams, bulkheads, or other ironwork, they should be led through special fittings of sheet lead, hard wood, or vulcanized fibre to prevent their being chafed, and where they pass through decks they should be led through metal tubes lined with wood or vulcanized fibre, and securely fastened to the decks, standing at such a height above the deck level that water cannot stand above them. Where cables pass through water-tight bulkheads the fittings must be made efficiently water-tight.

Where cables pass through insulation they should be of the highest quality, and should preferably be armoured. They should be strongly protected against chafing or other mechanical injury. They should be of at least the sectional area given in Table 1 for cables carrying twice the amperes which they will have to carry. The insulating material in their vicinity should be silicate cotton, not charcoal or cork, and where the cables pass through the wood linings of the insulation, the wood should be covered with sheet lead.

7. In vessels having spaces allotted alternately for passengers and cargo, the lamp fittings in these spaces should be removable, and the terminals so arranged that they can be properly covered up with strong metal covers, or the whole of the fittings should be similarly provided with strong iron boxes provided with iron covers, or otherwise securely arranged to prevent the fittings being tampered with.

THE CONTRACTOR-DEALER IN THE BANKING BUSINESS

BY ALBERT H. ELLIOT

(If you judge the success of your business by the turnover of your capital invested, you have got to keep that capital moving. The practice of credits and cash discounts all down the line, virtually makes each man the banker of the man below him—and leads to half the complications which beset the electrical industry. The author is secretary of the Electrical Credit Association of the Pacific Coast, and secretary and attorney for the Pacific Coast Electrical Supply Jobbers.—The Editor.)

Co-operation means "working with one another, but a great many contractors believe that the word "co-operate" means working on one another, and they proceed to put their definition of co-operation into practical effect at every opportunity. It pays to co-operate—it pays every man in the game, if we can tie all the interests in the electrical business together. It even pays the consumer.

One of the points at which co-operation is most needed is that of fixing the practice in granting credit to customers and in trade acceptances. I should say that the great trouble of the electrical business, looking at it from the viewpoint of trade acceptances, is that while our people are fairly good merchants from the standpoint of electrical appliances, and are fairly good masters of electrical power, yet I have never yet seen an electrical man in my life that did not want to be a banker. That is the queerest thing about the electrical business. Now, we are going to put the electrical man out of the banking business.

All that is needed is a little practical exemplification of co-operation. A contractor goes out and takes a contract for an installation job from the owner. The trouble usually begins with the owner. The contractor finishes his work, installs his electrical apparatus, has his inspection and his certificate of inspection—and goes to the owner and says: "My job is up; I want my money." The owner says: "I am very sorry, but I haven't the money right now—but I will pay you in thirty days." And when he gets around to pay it, it is ninety days. Now, during that time, the contractor has his capital involved in the cost of the material and the cost of the labor he has put into this tied-up job, and the contractor becomes, from the moment that he finishes his work, the banker of that owner. The owner is borrowing his money and most of the time isn't paying any interest.

Now, we want the contractor at that point to say: "I am in the electrical business and I am not a banker. You own this property where I did the work. Now, you go to your banker and borrow the money at the current rate of interest. I cannot afford to keep my capital tied up, when I can turn it three or four times. I have to earn an average of 16 per cent or I cannot keep in business. You go to the bank and let him give you the money and he will charge you 6 per cent, and you pay me my money and I will put it into another job."

Then the electrical contractor goes to the jobber and says: "I want to buy goods from you." The cash discount is an evil of the business. Why should the jobber reward you for paying your bills, paying what you owe when you owe it? The contractor and dealer owes the jobber the money and he ought to pay it. If the contractor and dealer is kicked out of the banking business and is getting his money promptly when the work is installed, he will turn around to the jobber and pay him. We say to the jobber: "You have got to get out of the banking business. No more banking business for contractors and dealers." When the jobbers' goods are sold, they are going to collect in cash from the contractor and dealer because the contractor and dealer collects cash from the owner, and he is getting his cash from the bank. The bank will get all the business and a good deal of it will be in the form of trade acceptances. No reason has ever been shown me why a manufacturer should reward a jobber for promptly paying his bills. There is no reason to sustain a 2 per cent cash discount. Outside of the banking business, a man who has capital tied up in a business ought not to be compelled to tie up an immense additional amount of money in the business in order to carry current orders, when we have the banks to do that and that is their business. You have got to keep your capital flowing and liquid. No branch of the electrical industry can afford to do a banking business.

CONSERVING LABOR IN A JOBBING BUSINESS

BY E. J. WALLIS

(There are three shortages of importance in the United States today—fuel, transportation and labor—and of these three, labor is the only one which presents permanent difficulty. This inspiring article, which offers concrete suggestions as to how the electrical jobber can meet the labor situation, was read at the January Pacific Coast Supply Jobbers' convention at Del Monte. The author is Pacific Coast manager of the Western Electric Company.—The Editor.)

If we were not so intensely concerned with a very definite personal duty and responsibility, it would be almost presumptuous, as it is certainly difficult, to attempt to emphasize the demand for a conservation of labor. Every agency preaches it and the word conservation is on our lips constantly.

We often experience some hesitancy in speaking the word because we have the feeling at times that we are not doing all we can in response to its demand, and at such times we probably are not. We are mindful also that there is a certain menace to which the word itself is subjected and its devitalization is possible, as has been the case to some extent with the word co-operation, which is preserved in its strength only when the element of sacrifice that is involved in what it should express is appreciated. Conservation will have a vital strength only if that same element of its character is recognized.

While it is difficult to put any new appeal into the demand for conservation, we can consider its application to our own circumstances and conditions and perhaps discover ways and means by which our business can be made to respond.

As a part of his daily tasks, the executive staff of a jobbing business has had the ever-present responsibility of conserving profits by careful economies and in times of reduced business, retrenchment has presented itself as a necessity, but retrenchment always has been garbed in mourning black. The old familiar demand is now resplendent in brilliant raiment of patriotism and tells us "If the Allies face a crisis today, it is a moral and political one, not a military crisis."

We are also told that we must equip ourselves as if the war were going to last ten years, but speed ourselves as if it were going to end in six months. Our enemy has very largely made the style of this war, at least so far. We have altered the style some to suit our taste and we will make further alterations as time goes on, but it is well for us to contemplate such evidence as is at our disposal of our enemy's conception of the possibilities.

Our meatless days and wheatless days and lightless nights are established, but we are still to an extent indulging in the workless day. We have seen Congress appropriate nineteen billions of dollars for war purposes, but the real problem is not dollars. The real problem is things—manufactured things. All the money the government ever spent from the first day of its foundation down to the beginning of this year, during all the wars and all the times of peace, foots only twenty-six billion dollars, and there is demanded from labor and from workshops a substantial part of nineteen billions in twelve months. The obvious conclusion is that labor must be released at once from making all the things it has been making for our comfort, for our pleasure, for our luxuries, and be freed for the work the government wants done. And a considerable part of the work the government wants done is the work of the soldier, which is the consumption, not the production, of the things required. We will conserve materials, of course, but for the sake primarily of conserving labor, because with labor in plenty, there is coal, iron, copper, and although subject to other restrictions, foodstuffs to be had in any quantity the necessity demands.

Lest you consider it needless to reiterate all these common qualities of the gospel we are accepting, they are presented in review because it is necessary that we develop a patriotic response to our efforts from our fellow employees. Each member and all of the members together of an organization must know the cause and feel that it is a common cause, and that labor is now employed under conditions more remotely removed from consideration of profit and compensation than ever before. The man who employs labor will feel the sense of responsibility that goes with a trust. He must use it without waste to the best advantage or be considered a slacker.

We have, then, a responsibility to examine our business, that comes from a higher source than the convenience or interests of the individual or the business itself. We are under obligation to examine the common elements of our affairs to see if courses of action will be suggested that we may employ. Some wholesale methods will be established to which all will be subjected, but the conservation of labor may be essentially the retail application of conservatism by those who have relatively small quantities at their direction.

In considering changes that might involve an altered character for our business of distributing electrical supplies as jobbers, we must not forget that we might lose our business when we lose our character. We know the jobber to be a convenience and worthy of hire, but we will be worthy and paid just so long as we perform our service. Our service, therefore, must be in its essentials preserved.

Clerks, bookkeepers, stenographers, messengers, are all laborers whose time is the precious commodity we have in trust.

System planted in any business is self-sustaining and self-developing, and grows like a tree, producing branches on which fruit for a time appears, but is later shaded from the light and becomes a useless drain on expense. The gardener trims such useless growth away. An examination of the systems we employ will develop some clerical work that at one time gave us results but is being continued without benefit. This is

particularly true of periodic statements of certain conditions of our business. The bookkeeper has been asked to make up a statement the use of which he does not entirely comprehend. The sales manager sees it week by week or month by month, and passes it along to another who has long since lost all interest in it.

Then there is work that has an apparent value, but of which we may properly dispense at this time. Perhaps an elaborate acknowledgment of an order may be made simple or done away with entirely. We may have made a practice of itemizing a statement balance beyond the current month. There are some who are advocating now that statements be dispensed with altogether, as most buyers pay individual bills, and often merely a report of a balance would permit of sufficient check as between accounts. This might at least be done with some of our largest customers. Remittances are made without expectation of acknowledgment or receipts. A style of correspondence can be developed that works automatically to produce short, concise letters and eliminate words and phrases like "beg to advise" and "beg to remain" and complimentary expressions. While we are going to be as courteous as ever, something more than has been the usual practice will have to be taken for granted. An executive once observed that he had succeeded in getting through a week and writing but three letters, and that when he read those three letters later he found that he could have dispensed with two.

There will be many by-products of value incident to this war, and not the least will be a substantial disposition toward thrift. The discipline to which we will have been subjected will make us more economical of our substance and our time. Every member of our organization will be more amenable to reasonable restrictions which will be made to reduce those daily periods of relaxation called loafing. Soldiering will describe hard work. If we have ever had a mistaken hesitancy about the maintenance of a reasonable strictness, the benefits that we will now observe resulting from discipline will convince us that organizations of whatever character are happier, more contented, and with less friction and misunderstanding, when subject to a proper and reasonable discipline. A direct result will be the elimination of some wasted time.

We have already referred to our office system as a growth that at proper seasons benefits by pruning. But action will follow examination, and for our purpose examination frequently requires the separation of a job or a man's work into its essential parts. Every ambitious man absorbs more and more work as he gains knowledge and experience. The measure of this capacity usually determines his compensation and he knows it. Consequently, he and many of his associates will be found to have assumed a burden of easy routine work that could be undertaken by less expensive and perhaps inexperienced help. When there are changes in our organization and men leave for the country's service, we will try by a detailed analysis of the jobs to determine if the work of say two experienced members, of which we are losing one, cannot be carried on by the one of experience and two beginners, and for the beginners we may be able to substitute women. All prejudice against women at work has disappeared and we are astonished at the tasks undertaken. It is no uncommon sight to see girls running elevators, and a railroad company has set thirty or more women sorting junk, the very heaviest sort of manual labor, and while perhaps the demand at present exceeds the supply of women help, the supply will be augmented by the special incentive at this time for women to go to work, and further, necessity will compel many to undertake their own support or assist in the support of their family.

A great variety of office appliances has been developed and many classify as time savers. We are all committed to the typewriter with its carbon copies, and are becoming converted to the graphophone and duplicating apparatus. While it pains us to see a modern clerk turn to an adding machine to foot up two or three figures, still he may be right, because his answer is sure to be. There are envelope openers and stamp fixers, pencil sharpeners, and other ingenious tools, both for the office and warehouse, on which labor has been expended, awaiting to be exchanged for money, of which we have plenty, to do a part in the reduction of the labor required to keep systems and work going. Maybe your bookkeeper has been asking you to buy some of these things.

It is human nature that labor's ideal should be better wages and shorter hours. Both have been possible as better production methods have been developed, but this ideal must take a place further back at least temporarily, if there is to be labor sufficient to go around. Longer work hours will be observed, but as the day's work is lengthened we will do well to guard against the effects of irregular hours. Indiscriminate and irregular overtime on office work is usually productive of confusion. It is doubtful if the work as a whole is set much further ahead. It has been observed in numerous cases that the condition of an office badly behind in its work and addicted to irregular overtime could be re-established merely by orders to cut out the irregular hours. Longer hours will come probably by having the day start earlier in the morning. For some classes of help, of course, work hours are established by law.

We are working between ourselves so free an exchange of stock, not in quantities large but in articles and transactions numerous, that at some centers it would seem that our efforts tended to introduce something expensively better than a reasonably standard service. If we could organize an exchange that would hold forth for an hour or two each day, perhaps by telephone, we might possibly be able altogether to save a considerable amount of time and effort without inconvenience to our customers.

It is not impractical to expect that our customers —the buyers—will work with us to conserve labor. We may be privileged to ask that they help us eliminate wasteful occupation. They should be more disposed to mail in an order to the house of their selection, rather than wait several days for a saleman's call and then demand some emergency service because of the delay. Individual standards will make way for general standards. The buyer who has standardized on some piece of special equipment should not use the pressure of his buying power to dope longer life into his specialty, but should quickly accept the standard substitute.

WHAT WESTERN INVENTORS ARE DOING

(You cannot issue your own patent plus an improvement if another man has received a patent on the addition. Protection against infringement is afforded by the knowledge of how to word your claim wisely. As technicalities of patent law are involved, this lucid article by well-known authorities on the subject should be studied carefully. The authors are prominent patent attorneys of San Francisco.—The Editor.)

NOTES ON THE LAW OF PATENTS

BY WM. K. WHITE AND H. G. PROST

In the preceding issue we discussed the various claims which one, Jones, might have been granted on a chair which involved the use of casters, it being assumed that Jones was the first in the art to apply casters to the legs of chairs. We will now continue with our hypothetical case and discuss the relation of an improved construction to the Jones patent.

Improvement Patent

Let us assume one, Smith, improves on Jones' invention by adding anti-friction rollers to the casters attached to the legs of a chair and that such rollers are provided with ball bearings. Smith would be entitled to a patent on his improvement and could word his claims thereon, as follows:

Generic claim: In combination, a chair, casters attached to the legs thereof and anti-friction rollers applied to said casters.

Specific claim: In combination, a chair, casters attached to the legs thereof, anti-friction rollers applied to said casters and ball bearings for said rollers.

Infringement by Use of Patented Improvement

Smith, without a license from Jones under the Jones patent, could not lawfully make, use or sell a chair embodying the Smith improvement, because, in so doing, he would infringe the prior Jones patent covering a chair + casters. In other words, Smith, in order to use his own invention, embracing a chair + casters + anti-friction rollers, would be compelled to use the Jones invention embracing a chair + casters. However, the prior Jones patent grants to Jones the right of preventing all others from making, selling or using a chair + casters and, therefore, Jones, under his patent, could enjoin Smith from making, using or selling a chair + casters + anti-friction rollers.

On the other hand, the subsequent Smith patent grants to Smith the right to prevent all others from making, using or selling a chair + casters + anti-friction rollers. Therefore, Smith could enjoin Jones from adding anti-friction rollers to the Jones patented combination of a chair + casters.

Nature of Patent Monopoly

The foregoing illustrates the fact that the grant of a patent is not the grant of the right to make, sell to use devices embodying the invention covered by the patent. The right, granted by a patent, is only the right of preventing all others from making, selling or using devices embodying the invention covered by the patent.

Smith would not have the right to embody his own patented improvement in a chair structure until after the expiration of the Jones patent giving Jones the monopoly of two of the elements employed by Smith in Smith's improved device.

Until after the expiration of the Smith patent giving Smith a monopoly of anti-friction rollers used with the combination of a chair + casters, Jones would have no right to apply such anti-friction rollers to the Jones patented combination of a chair + casters.

Reason Why Infringement Not Considered by Patent Office

The foregoing situation illustrates the reason why the Patent Office does not consider the question of infringement in passing on an application for a patent.

The patentability of Smith's improvement on Jones' prior patented invention does not depend on whether or not such Smith improvement can be made, sold or used without infringing Jones' patent. If the Smith improvement is novel, useful and the product of an inventive act, Smith is entitled to receive a patent thereon.

The granting of such a patent to Smith does not conflict with the monopoly granted by the Jones prior patent. Jones is still free to make, sell and use the combination of a chair + casters. The Smith patent monopoly merely enables Smith to prevent Jones and everyone else from adding anti-friction rollers to the Jones combination.

Let us assume Smith inserted, in his application, the following claim:

"In combination, a chair and casters attached to the legs thereof."

In considering the novelty of such claim, the examiner would search the prior art and run across the prior Jones patent. On finding disclosed in the Jones patent, the combination of a chair + casters, he would reject such Smith claim on the Jones patent, as the same shows Smith was not the first one in the art to combine a chair and casters, and, therefore, was not the original and first inventor of such a combination.

However, the Jones patent would not prevent Smith from securing a claim covering the combination of a chair + casters + anti-friction rollers, because Jones does not disclose any anti-friction rollers in his patent. The fact that the Jones patent claims the combination of a chair + casters does not affect the novelty of Smith's combination of a chair + casters + anti-friction rollers.

Value of Improvement Patent

The fact that Smith cannot lawfully make, sell or use his patented improvement does not necessarily make his patent valueless. If Jones wishes to use anti-friction rollers, in the Jones patented combination, he may be willing to either purchase the Smith patent or take a license thereunder from Smith on a royalty basis. On the other hand, Smith may be able to purchase the Jones patent or take a license from Jones, and thereby be in a position to lawfully exploit his own patented improvement. A third party may be

willing to purchase both patents in order to exploit the inventions, respectively covered by them.

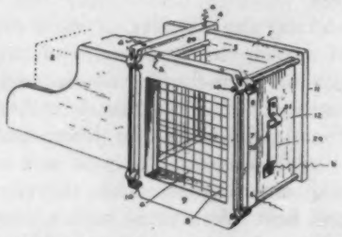
Exemplar Claims Considered in Light of Other Patent Law Principles

As heretofore stated, the foregoing claims are not intended as correct examples of all patent law principles. For instance, the validity of the claim for a chair + casters might be attacked on the ground that no invention was required to first apply casters to a chair. Assuming that casters had been previously applied to a table, the subsequent application of casters to a chair might be adjudged a mere "double-use" or more extended use of casters and the courts usually hold that such a mere "double use" of a device does not amount to invention. The validity of the claim for a chair + arms and therefore + casters might be attacked on the ground that there was no co-operation between the arms and casters and, therefore, the claim was for a mere aggregation of elements and not for a true patentable combination. The claim for a chair + casters + anti-friction rollers + ball bearings might be rejected by the Patent Office on the ground that the real invention was an improved form of caster, adaptable for use with various articles and, therefore, the chair should not be made an element of the claim.

NEW IDEAS FROM THE WEST

Electric Ice Cutter

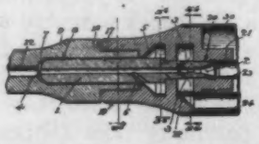
Patent No. 1,250,010, issued to Germain Pouchan of San Francisco, discloses a novel form of machine for cutting a block of ice into cubes for use in hotels and restaurants. The machine consists of two sets of vertically arranged electrically heated wires arranged at right angles to each other. One set consists of a series of vertical wires against which the block of ice moves and these wires cut the block into slabs. The other set consists of vertical and horizontal wires against which the slabs move sidewise, and by which they are cut into



cubes. The block of ice is placed on an inclined chute so that it is pressed by gravity against the first set of hot wires. After having passed through these wires the slabs press a switch which opens the circuit through the first set of wires and closes it through the second set of wires, and the slabs are pressed by gravity against the second set and are cut into cubes.

Apparatus for Connecting Service Wires to Charged Main Wires

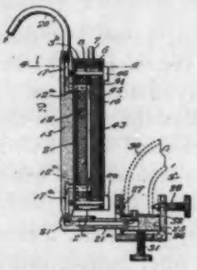
Patent No. 1,249,898, issued to Hazel Burton Bush of Redlands, California, discloses an apparatus whereby a service wire may be properly and safely connected to a live feed



wire. The apparatus consists of a rotatable head having a slot therein to receive the feed wire and having a jaw thereon for gripping the end of the service wire. The head is provided with an insulating handle so that the apparatus may be manipulated without danger. The service wire is fitted into the jaw and the head slipped over the feed wire. The head is then rotated, causing the end of the service wire to be evenly and tightly coiled around the feed wire to produce a tight connection, after which the head is released from the feed wire, leaving a service connection.

Electric Water Heater

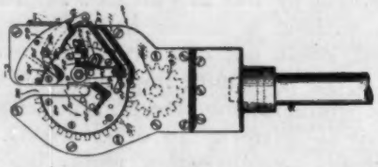
Patent No. 1,249,285, issued to Milton H. Shoenberg of San Francisco, and assigned to the Majestic Electric Development Company, discloses a novel form of instantaneous



electric water heater. The heater comprises a casing in which is arranged two spaced carbon electrodes which are separated by a marginal insulating packing, whereby a chamber is formed between the electrodes. One of the electrodes is provided with inlet and outlet water passages opening into the chamber, so that the water to be heated passes through the chamber, wherein it is heated by the current passing through it from one electrode to the other.

Gas Burner

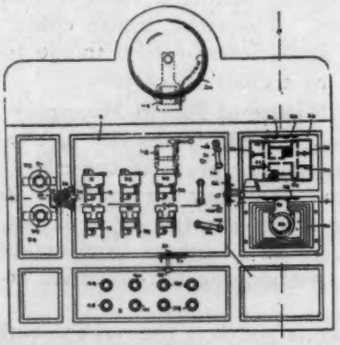
Patent No. 1,248,895, issued to Carl J. Nyquist of Los Angeles, California, shows a gas burner which is constructed to prevent a flash back into the gas pipe. This is accomplished



by providing a chamber within the burner which is large enough to contain sufficient gas to produce an explosion in the event of a flash back, and this chamber is so connected with the gas passage in the burner that the explosive gases are directed toward the end of the burner, whereby the flame is blown out and a flash back into the pipe prevented.

Combined Fire Alarm and Annunciator

Patent No. 1,249,717, issued to John Carrigan of Seattle, Washington, discloses a novel form of combined firm alarm and annunciator. This device comprises a plurality of drop



annunciators, a testing button for each drop, and a reset magnet for the drops. A gong is included in the device and means are provided for cutting the gong in or out of the annunciator circuit, so that the device may be used as a fire alarm when desired.

SPARKS—Current Facts, Figures and Fancy

(The steady increase in the use of electricity and the discovery of new applications, from milk sterilization to the heating of hospital beds, continues in spite of rulings everywhere for the reduction of fuel consumption for other than war purposes. Greater efficiency in the utilization of our energies rather than a cutting down of their consumption, is the great message of economy which the war is driving home.—The Editor.)

The electric flat-iron now keeps union hours. Owing to the necessity for conserving electric power for war service, the province of Turin, France, has forbidden the use of electricity for any domestic purposes between the hours of 7 a. m. and 8 p. m.

* * *

Electric canoes are becoming very popular on the upper Thames. The most modern electrics are equipped with steering wheels, operating a three-bladed propeller through a pinion and a rachet. A 30-cell battery, the usual capacity for one day's run, is commonly used.

* * *

A revolving searchlight, flashing the national colors through electric nitrogen lamps, aggregating 275,000 candle power, is the boast of Spokane. The rays of the light, which flash intermittently from dusk until midnight, can be seen for twenty miles in any direction on a clear night.

* * *

The Portland street car conductor's lot cannot be a very happy one. The Public Service Commission has allowed an increase of fares to six cents, and passengers are demanding a receipt when they pay the extra cent, so that they may recover if the Supreme Court fails to sustain the higher rate.

* * *

Persistent trouble on a telegraph line near Eugene, Oregon, has at last been traced to the short-circuiting of insulators by soot. The wires ran through a 4,800-foot railway tunnel, and it has been found that the smoke from the locomotives has gradually coated the insulators with soot until they are no longer nonconductors.

* * *

Electricity is proving its value in war as well as in the arts of peace. Electrically heated beds have been found of advantage in the treatment of shock at field hospitals, and for military purposes it will be seen that the current required may be instantly supplied from a portable dynamo driven by a motor lorry or car attached to a field hospital.

* * *

By exporting electricity, Sweden has somewhat relieved the fuel shortage in Denmark. Although they are arranging to lay additional cables across the sound, with the intention of furnishing the street-car service of Copenhagen and Frederiksberg with a large amount of power, the difficulty in obtaining copper cables and electric transformers is delaying this work.

* * *

Brick as a building unit dates back to very early times. The first bricks of which there is authentic record were found on the sites of the ancient cities of Babylonia, dating back as far as 3400 B. C. In America, Virginia hands down to us, along with some of our most cherished history and tradition, a record of the first brick manufactured on this continent, in 1611.

* * *

A miniature electric lighting plant modeled in wax, to be used by an industrial exhibit at Tacoma, Washington, reproduces not only the power plant but the river from which it derives its power, the mountains, and the river canyon, where the headworks will be shown. The miniature river will be lighted with scores of tiny Mazda lamps placed beneath the water.

* * *

It is necessary not only to have sugar to eat, but also to see by, as was developed by the recent sugar shortage of the East. It seems that brown sugar is used in infinitesimal amounts in the manufacture of electric globes, and officials of one of the large lamp companies appealed to Federal food authorities for 35 pounds weekly of brown sugar, stating it would be necessary to suspend operations in the company's plant unless the request was granted.

* * *

"Music that is visible" was recently inaugurated at a concert at the Greenwich Village Theatre, at which electric lights were used to give the related atmospheric setting to the compositions. Debussy's prelude in A minor, for instance, was accompanied by a rainbow thrown upon a background of neutral curtains. The "Soiree dans Grenade" was realized in amber and pink, and the "Poissons d'or" in green. The house was dark and the pianist invisible.

* * *

The life of the operator is absolutely dependent upon the strength of construction in an aeroplane—as well as with so many of our great electrical machines. One faulty part may lead to fatal results. To secure this strength, over four thousand nails, some thirty-two hundred feet of wire, and three thousand three hundred-odd screws are put into the assembling of a single aeroplane.

* * *

Germs, like human beings, are susceptible to electric shocks, and when a current passes through their minute bodies they succumb to heart failure. This fact has been used in a series of experiments carried on by a group of scientists in Liverpool, England, to test the possibilities of the sterilization of milk by electricity. They have passed the alternating current through the milk with the object of discovering whether the sterilization which results is due to electrolytic dissociation in the neighborhood of the electrodes. Sufficient progress has been made with the experiment to encourage the committee to proceed further.

PERSONALS

Mark L. Requa, who has been appointed oil administrator for the nation, is a capitalist and mining engineer of San Francisco and Oakland. Mr. Requa for many years was prominent in the oil-producing industry of California. Because of his combination of practical experience in oil production and distribution with technical knowledge gained by his professional education for engineering, he for some time has been consulting engineer of the Bureau of Mines, with rank as a specialist in oils. His professional status may be inferred from the fact that he is a vice-president of the American Institute of Mining Engineers and a member of the Mining and Metallurgical Society of America. The vital part which fuel oil plays in the generation of electricity in the West makes Mr. Requa's appointment particularly important to the electrical industry.

Lamar Cobb, Phoenix, Arizona, has been appointed state engineer of Arizona, succeeding Thomas Maddock, resigned.

Louis A. McArthur, general manager of the Pacific Power & Light Company of Portland, is a recent San Francisco visitor.

J. O. Broili, electrical engineer at Reno, Nevada, was recently appointed chief engineer for the Nevada Public Service Commission.

Sidney R. Inch has succeeded C. E. Groesbeck as vice-president and general manager of the Utah Power & Light Company at Salt Lake City.

J. E. Poingdestre, after serving twelve years as manager of the Marysville, Cal., branch of the Pacific Gas & Electric Company, resigned recently.

George C. Holberton, San Francisco manager of the Pacific Gas & Electric Company, is secretary of the Association of Edison Illuminating Companies.

B. G. McBride, manager of the Elko-Lamoile Power Co. at Elko, Nevada, has gone to Washington, D. C., to take an examination for captain in the U. S. Army.

E. H. Eardley of Salt Lake City, Utah, secretary of the Utah Society of Electrical Contractors and Dealers, was recently in San Francisco on business for a few days.

W. M. Fraser, electrical superintendent of the British Columbia Electric Railway, Ltd., of Vancouver, B. C., has been given full charge of the operating end of the business.

F. S. Easton, hydro-electric engineer of the British Columbia Electric Railway, of Vancouver, B. C., has been given full charge of the power-producing plants of the company.

V. S. McKenny, local manager of the NePage-McKenny Co., is back from New York and taking hold of the large amount of business which that company now has under construction.

P. H. Ridgway, electrical and mechanical engineer of Seattle, Wash., was some time ago commissioned captain of Engineers, U. S. R., and is anticipating orders to report some time this month.

F. J. Zorn, Seattle manager of the Pacific States Electric Company, attended the quarterly meeting of the Pacific Coast Section of the Supply Jobbers' Association, held at Del Monte, Cal., January 24, 25 and 26.

F. S. Pratt, of Boston, an official of the Stone & Webster concern and chairman of the board of directors of the Puget Sound Traction, Light and Power Company, recently visited Seattle on business matters.

Raymond W. Murphy has been transferred from the Pacific Coast offices of the Westinghouse Lamp Company, to the Philadelphia office, where he will hold the position of assistant manager.

L. C. Bewsey, formerly superintendent of the Buffalo, Lockport & Rochester Railway, at Rochester, N. Y., has accepted a position with the Manila Electric Railway & Light Company, of Manila, P. I.

C. E. Groesbeck has resigned as vice-president and general manager of the Utah Power & Light Company at Salt Lake City, to assume executive duties with the Electric Bond & Share Company at New York City.

E. C. Johnson, superintendent of the Pacific Gas & Electric Company at Marysville, Cal., has been named manager of the company, succeeding J. E. Poingdestre. Mr. Johnson will now asume the duties of both offices.

G. H. Jameson, manufacturers' agent, Mercantile Building, Vancouver, B. C., returned November 24th from a trip to northern points, the itinerary covering the pulp and paper plants at Powell River, Swanson's Bay and Ocean Falls.

S. E. Vance, of the state engineer's office, Idaho, who has been in charge of the distribution of the stored water in Jackson Lake, Wyoming, to the Twin Falls, has recently entered in the Twenty-third Engineers' Highway Regiment.

J. I. Brown has resigned as general manager of the Nevada Valleys Power Company. The company's offices have been transferred from Oakland, Cal., to Lovelock, Nevada, with **Joe Beane** in active charge as general superintendent.

H. B. Jones has been brought to Astoria by the Pacific Power & Light Company to investigate the problem of providing facilities for taking care of the power demands of the territory, and he has spent the past three months working on the matter.

Milton Rupert was recently elected vice-president and assistant treasurer of the R. D. Nuttall Company of Pittsburg, Pa., manufacturers of gears, pinions and trolleys. In his new position, Mr. Rupert will have charge of sales and manufacturing activities.

John Harisberger, general superintendent of the light and power department of the Puget Sound Traction, Light & Power Company, and chairman of the Seattle Section of the American Institute of Electrical Engineers, has received a captaincy in the Engineers' Officers' Reserve Corps.

G. W. Hawkins, power engineer for the firm of Andersen, Meyer & Co., Ltd., of Shanghai, was a passenger on the last Empress liner to leave Shanghai for America. This trip is taken in connection with a large contract for electrical supplies which he recently closed on behalf of his firm with a Chinese electric company in Canton, South China. Mr. Hawkins is expected back in Shanghai next March.

A. L. Spring, Southern California field representative for the co-operative educational campaign of the commercial section, Pacific Coast Section, N. E. L. A., was a recent attendant at the Sacramento quarterly gathering of the California Association of Electrical Contractors and Dealers. Mr. Spring later briefly addressed the weekly gathering of the San Francisco Electrical Development League. This splendid original campaign of co-operative education among all the branches of the electrical industry is receiving substantial backing from every quarter, and the best wishes of the West go with Mr. Spring in his endeavors.

A. S. Hall, formerly district manager of Pacific Power & Light Company at Pasco, Wash., is now captain in 56th Engineers at Washington, D. C. The regiment is largely composed of central station men and is known as the Searchlight Regiment.

Roy Page, formerly in the office of the electrical engineer of the Southern Pacific Company, who went to Omaha last summer to the Nebraska Power Company, has been appointed assistant to Vice-President and General Manager J. E. Davidson of that company.

Guy A. Richardson, superintendent of Railway, Puget Sound Traction, Light & Power Company, Seattle, has returned from the East, where he went to make a traffic and transportation study of the problems confronting the American International Shipbuilding Corporation at Philadelphia.

F. H. Newell, for many years director of the Reclamation Service, has been selected by the President to be executive officer in charge of water-power developmnt. Under the terms of the new Administration water-power bill, soon to be considered, this proposed position carries a salary of $10,000 a year.

Gerard Swope, vice-president of the Western Electric Company, will be given the Fourth Order of Merit, with the Minor Cordon of the Rising Sun, by the Emperor of Japan. The decorations are awarded, it is stated, in appreciation of services rendered toward the advance of the electrical industry in Japan.

A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation, is rendering able service on the advisory board for the co-operative educational campaign now under way in California by the commercial section of the Pacific Coast Section, N. E. L. A. To this end his presence in San Francisco and Los Angeles of late has been frequently noted. Meanwhile his energies in behalf of

his company are not suffering. Here he is on the right of the picture in which he is shown with **J. B. Carter,** district agent of his company for the west side oil fields of Kern county, seated upon a pile of pipe casing watching an oil well being driven by electricity.

H. B. Pickering, manager of the Foundation Company's Tacoma plant since its location there, has been appointed engineer of construction for the company and will be assistant to Bayly Hipkins, district manager of the concern. Mr. Pickering will supervise all the construction at the Portland, Tacoma, and Victoria, B. C., plants.

Chas. T. Main, of Boston, president of the American Society of Mechanical Engineers, has designed and supervised the construction of numerous industrial, steam power, and water power plants. Among the larger of his undertakings are four hydro-electric developments for the Montana Power Company, aggregating about 280,000 horsepower.

Hugh L. Cooper, hydraulic engineer, who made Spokane his headquarters at one time, and who holds an option on the Z Canyon water-power site on the Pend Oreille river below Metaline Falls, is now in France and holds a commission as lieutenant-colonel in the American army. He is in charge of important construction work.

G. A. Strain, formerly general manager of the gas department for the Helena (Mont.) Light & Railway Company, one of the J. G. White Management Corporation properties, has recently been promoted and will have charge of five gas plants in the East operated by the White corporation. Mr. Strain has been in Helena about ten years.

W. H. McGrath, vice-president of the Puget Sound Traction, Light & Power Company, has been made Washington state representative of the traffic committee of the American Electrical Railway Board with offices in Seattle. He is cooperating with the King County Council of Defense in solving the problem of transportation of shipyard workers to and from their places of employment.

W. S. Ford, Lieutenant, Royal Garrison Artillery, 122nd Siege Battery, B. E. F., who has been elected an associate member of the Canadian Society of Civil Engineers, was formerly assistant hydraulic engineer with the Canadian Boving Company, designing water power plants, Diesel engine plants, etc., and also with the Western Canada Power Company, Stave Falls, B. C., on power house construction, waterways, surveys, etc.

A. C. Houston has taken charge of the Yolo Water and Power Company as president to succeed Olaf Ussing. Mr. Ussing had accepted, temporarily, two weeks ago, when W. G. De Celle resigned. **L. J. Shuman** will be general manager, and is making arrangements to move here from Lakeport, Lake county. Mr. Shuman has been in charge of the Lake county division of the company.

P. M. Downing, chief engineer of the hydro-electric department of the Pacific Gas & Electric Company, has been appointed manager of operations for the tying-in and joint operation of the three large hydro-electric companies of Central California—The Pacific Gas & Electric Company, The Great Western Power Company, and the Sierra and San Francisco Power Company. This interconnection will probably serve more square miles of territory under one management than ever before attempted in hydro-electric practice.

Max Thelen, president California Railroad Commission, has inaugurated the University of California extension course on public utility problems. This university extension course is open to all and is directed especially to lawyers, bankers, officials and employees of public utilities, city and county officials and others particularly interested in problems of regulation of public service corporations, and in the way in which they are being worked out by the commissions. Commissioner **E. O. Edgerton** gave the lecture on the evening of January 23, 1918.

Captain H. A. Kluegel, who is superintendent of buildings and grounds at Camp Lewis, will be connected with the staff of Major John Coffee Hays, in charge of the utilities at the camp. Captain Kluegel left his practice as consulting engineer in San Francisco to take up his work for the government. He has been identified with many large projects on the Pacific Coast and was chief engineer of construction on a South American railway. For five years he was associated with Major Hays in the construction of power plants in California as chief engineer of the Mount Whitney Light & Power Company.

W. R. Bonnycastle of Vancouver has been elected a member of the Canadian Society of Civil Engineers. He is in practice as a consulting hydro-electrical engineer, specializing on water power development, and is also engineer for the Bridge River Power Company and the Indian Power Company, B. C. Besides being connected with Mr. R. S. Kelsch, of Montreal, on the design of the Kaministiquia Power development, Fort William, Mr. Bonnycastle was electrical engineer with the Stave Lake Power Company, designing engineer with the Western Canada Power Company, and engineer for Smith, Kerry & Chace.

MEETING NOTICES FOR ELECTRICAL MEN

(Plans for the spring convention of the Pacific Coast Section, N. E. L. A., are nearing completion, and are here given in detail. An interesting meeting of the San Francisco Development League, which brought architects and electrical men into closer touch, was a major event of the two weeks period. Reports of an important Agricultural and Engineering Conference in Idaho, and a meeting of the League of the Southwest in Arizona, as well as other local gatherings, follow.—The Editor.)

The San Francisco Electrical Development and Jovian League

The League meeting for Wednesday, January 16, 1918, at the Palace Hotel, was devoted to a discussion of future league policies. It was the overwhelming sentiment of the meeting that the league divorce itself from the Jovian Order, not with any reflection upon that order, but that an open forum might thus be provided where jobber, contractor, engineer, central station man, members of the A. I. E. E., N. E. L. A., and other associations, might discuss problems before an open body without any affiliations whatsoever. The proposed new constitution is to be found on another page of this issue.

On Wednesday, January 23, 1918, was held Architects' Day, which proved perhaps the most helpful of all the helpful meetings of the season. Louis C. Mullgardt, designer of the Court of the Ages at the P.-P. I. E., and B. R. Maybeck, designer of the Palace of Fine Arts at the P.-P. I. E., John J. Donovan, architect of the City of Oakland; H. C. Reid, president of the California Association of Electrical Contractors and Dealers; H. P. Pitts, of the industrial department of the Pacific Gas & Electric Co.; and Sylvain Schnaittacher, secretary of the American Institute of Architects, all spoke, presenting new and helpful ideas. The gist of the discussion was that the league should father a movement to present electric data to the architect in a more brief and unified form and that electric inspection for safety, fire and other matters should be made clearer in interpretation to the architect.

BUILDERS OF THE WEST—XXII

JOHN D. RYAN

The electrification of a transcontinental railway over the Continental Divide has not only thrilled the entire world with a new and romantic field of usefulness for electrical energy, but the economies that are daily being brought to life from operating statistics fully bear out the sound thought of the constructive mind that planned the original conception for transcontinental railway electrification in the West. To John D. Ryan, financier and builder with the Montana Power Company, this issue of the Journal of Electricity is dedicated as a lasting memorial to his contribution to the upbuilding of the West.

Joint Conference of Agricultural, Engineering and Irrigation Societies of Idaho

A convention of unusual interest recently held in Idaho was known as the Joint Conference of Agricultural, Live Stock, Engineering, and Irrigation Societies. More than twenty-five of the food-producing organizations which hold annual meetings in different parts of the state, arranged to gather during the week of January 14-19, inclusive, in Idaho Falls. Sectional meetings were held by the different societies in the afternoons, while the mornings and evenings were given over to hearing important agricultural, live stock, engineering, and irrigation messages from government experts, who were brought at the expense of the conference.

Two of the important features of the conference were the annual meetings of the Idaho Society of Engineers and the holding of the annual Irrigation Congress. Leading engineers and irrigationists of the state had the programs in charge. At the Irrigation Congress Chairman R. E. Shepherd, of Jerome, Idaho, extended the official welcome. John H. Lewis, state engineer of Oregon, talked on "Water Control in Oregon." Prof. S. T. Harding, of the University of California, was scheduled to address the meeting on "Duty and Function of Irrigation Water." "Hydrometric Work" was the subject of Lynn H. Crandall, of Jerome. Experts also discussed "Transportation by Truck Lines."

Telephone and Telegraph Society

At the meeting of the San Francisco Section, Telephone and Telegraph Society of the Pacific Coast, on January 24th, Lieutenant Comte de Mailly Chalon, aviator of France, spoke on "The War in the Air." Lieutenant de Mailly Chalon has recently been sent by his government to Russia, where he has been developing airmen for the Russian Army, and he is now returning for further service in France.

League of the Southwest

At the recent meeting of the League of the Southwest, at Tucson, Arizona, C. E. Grunsky of San Francisco, consulting engineer for the Imperial Irrigation District, urged the establishment of state boards to investigate irrigation projects, and to recommend them when found worthy, and the centralization of the engineering work of the various departments of the government under one head for public works.

The league resolved to recommend that the national government have a study made of the entire Colorado River drainage basin, with a view to selecting necessary and feasible sites and constructing and operating the works required to conserve and utilize the flow of river, and to reduce the annual flood menace.

It was recommended that negotiations be opened with Mexico for a revision of the present treaties and agreements in such manner as to allow a just apportionment of water for irrigation purposes and flood control on both sides of the international boundary, and that the continued disuse of the lower river for navigation purposes be recognized and all such rights be abrogated.

Engineers' Club of Oakland

On Wednesday evening, January 16th, in the Commercial Club, Hotel Oakland, George A. Posey, C. E., Chief Deputy County Surveyor, spoke before the Engineers' Club of the Oakland Chamber of Commerce on "The Oakland Estuary Bascule Bridge."

Jobbers' Meeting

The annual meeting of the Pacific Coast Section of the Electrical Supply Jobbers' Association was held in Del Monte, January 24th to 26th.

W. S. Berry, manager of the San Francisco district of

the Western Electric Company, was elected chairman for the ensuing year to succeed Colonel Sam Taylor.

The many new problems arising from present abnormal conditions occupied the time devoted to meetings. Mr. E. J. Wallis of the Western Electric Company presented a paper on "The Obligation Entailed by the Present Demand for Labor, and Some Suggestions on Ways and Means of Conserving Labor," which proved of such interest to all that we have pleasure in publishing it in this issue of the Journal for the benefit of our readers.

D. E. Harris, sales manager of the Pacific States Electric Company, in the proud holder of the jobbers' copper golf cup for the next quarter, and J. A. Vandergrift of the National Lamp Works is temporary guardian of the Turner trophy. H. B. Squires modestly accepted the manufacturers' cup in a short but pithy speech.

The next meeting of the association will be held at Del Monte in April in conjunction with the Pacific Coast Section of the N. E. L. A. and the California Association of Electrical Contractors and Dealers.

The Del Monte Convention of the Pacific Coast Section, N. E. L. A.

A meeting of the convention committee of the Pacific Coast Section, N. E. L. A., under the chairmanship of Robert Sibley, editor of the Journal of Electricity, met at the San Francisco Engineers' Club on Monday, January 21, 1918. This central committee, composed of representatives of the jobbers, the contractors and the central stations, has complete charge of arrangements for the convention. Practically all members of the committee as announced in the issue of the Journal of Electricity for January 15, 1918, were present, with the exception of the members from Southern California. The next meeting is called for Friday noon, February 8, 1918, at the Engineers' Club, at which permanent subdivision of work will be made. At a later date it is planned to hold a meeting in Los Angeles so that arrangements for the convention from that part of the state may be perfected, in case these men cannot attend the meeting in San Francisco on February 8th.

The plans thus far outlined are broad and comprehensive. The convention is to be called to order at the Del Monte Hotel, Wednesday, April 24, 1918, at 2:30 p. m. This first session will be devoted to the president's address and general business and executive affairs of the section, and report of the auditing committee. All day Thursday will be given over to a discussion of war emergency engineering under the the auspices of the engineering committee, J. E. Woodbridge, chairman. Throughout Friday, the sessions of the convention will be given over to war emergency discussion by the commercial section, R. M. Alvord, chairman.

On Wednesday evening the formal ball will take place at the Del Monte Hotel. Thursday evening will be devoted to dancing and other recreations. Friday evening will be the banquet. Saturday morning will be a golf tournament and out-door sports for men and women guests. The afternoon of Saturday will be taken up with autoing through the seventeen-mile drive, with a wind-up for dinner at the Carmen Highlands.

Special trains will run from both Los Angeles and San Francisco. The entire affair is receiving the enthusiastic support it deserves, since the proposed war discussions are recognized as timely and of great present value to the industry.

The work of the convention committee, under the general direction of the chairman, is divided up as follows, and no other committees or apportionments of duties have been authorized:

Entertainment—R. E. Fisher, Pacific Gas & Electric Co.

Reception—R. F. Behan, Westinghouse Electric & Manufacturing Company.

Program—J. W. Redpath, California Electrical Contractors' Association.

Banquet—T. E. Bibbins, Pacific Electric Company.

Finance—M. A. DeLew, California Electrical Contractors' Association.

Out-door Sports—W. S. Berry, Western Electric Co.

Registration—H. P. Pitts, Pacific Gas & Electric Co.

Automobile—H. C. Reid, Pacific Coast Fire Extinguisher Company.

Transportation and Hotel—W. M. Deming, Journal of Electricity.

The members of the committee from Southern California will be asked to organize and work jointly with these several committees. Additional activities of the convention committee will be published in this column in subsequent issues of the Journal of Electricity.

WHERE THE MEN OF THE INDUSTRY MEET

(The place where you can find where and when the other man meets. Information as to changes in officers, or additions or corrections, should be addressed to the Service Editor, Journal of Electricity. It is hoped to keep this directory up to date, so that travelers in a strange town who wish to attend the meetings of allied groups may not be misdirected.—The Editor.)

A. I. E. E.—WESTERN SECTIONS

National Officers

President—E. W. Rice, Jr., Engineering Society Bldg., New York City.
Secretary—F. L. Hutchinson, Engineering Society Bldg., New York City.
Meetings—Monthly.

Los Angeles Section

Chairman — Don. D. Morgan, 621 Pacific Electric Bldg.
Secretary—A. W. Nye, University of Southern California, Los Angeles, Cal.
Meetings—Second Tuesday of each month.
Next meeting—February 12. Speaker: J. F. Wilson, University of Southern California, on "Tendencies in Design of Generators."

Portland Section

Chairman—S. D. Searing, care Portland Railway, Light & Power Co., Electric Bldg., Portland, Ore.
Secretary—R. M. Boykin, care North Coast Power Co., 441 Pittock Block, Portland, Ore.
Meetings—Monthly.

Denver Section

Chairman — Norman Read, 828 Symes Bldg., Denver, Colo.
Secretary — Robt. B. Bonney, 603 Wyoming Bldg., Denver, Colo.
Meetings—Third Saturday of each month, from October to May, at the Denver Athletic Club. Dinner at 6:15 p. m., followed by regular meeting.
February meeting—February 16th.

San Francisco Section—

Chairman—Lars R. Jorgensen, Chronicle Bldg., San Francisco.
Secretary—Allen G. Jones, Rialto Bldg., San Francisco.
Meetings — Fourth Friday each month—Engineers' Club, 7 p. m.
Next meeting—February 22.

Seattle Section

Chairman — John Harisberger, 4015—4th Ave., N. E., Seattle, Wash.
Secretary — Glen Dunbar, City Lighting Department, Seattle, Wash.
Meetings—Monthly on third Tuesday in Chamber of Commerce Assembly Room, 9th floor, Arctic Bldg.

Spokane Section

Chairman—Charles A. Lund, W. 828 Providence, Spokane, Wash.
Secretary—J. E. E. Royer, W. 408 Cleveland, Spokane, Wash.
Meetings—Third Friday of each month.
Next meeting—February 15. Subject: "Distribution of Electricity."

Utah Section

Chairman—A. S. Peters, Mountain States Telephone & Telegraph Co., Salt Lake City, Utah.
Secretary—H. T. Plumb, 183 U St., Salt Lake City, Utah.

Vancouver Section

Chairman—R. F. Hayward, Western Canada Power Co., Ltd., Vancouver, B. C.
Secretary—T. H. Crosby, Canadian Westinghouse Co., Vancouver, B. C.

A. I. E. E.—WESTERN BRANCHES

University of California Branch

Chairman — A. J. Swank, University of California, Berkeley, Cal.
Secretary—G. F. Teale, University of California, Berkeley, Cal.

Colorado State Agriculurtial College
Chairman—R. C. Richards.
Secretary—W. A. Stallings, Colorado State Agricultural College, Fort Collins, Colo.

University of Colorado Branch
President—Robt. Newman, 1071—11th St., Boulder, Colo.
Secretary—William N. Gittings, 2429—12th St., Boulder, Colo.
Meetings—First and third Thursdays of each month of the school year in the Engineering Building, University Campus.

Idaho University Branch
Chairman—V. Pearson, Moscow, Idaho.
Secretary — L. J. Corbett, University of Idaho, Moscow, Idaho.
Meetings—First Wednesday evening of each month from October to June.

Oregon Agricultural College Branch
Chairman—J. A. Hooper, Oregon Agr. College, Corvallis, Ore.
Secretary—L. Happold, Oregon Agr. College, Corvallis, Ore.

Stanford University Branch
Chairman—H. W. Lewis, Stanford University, Cal.
Secretary—A. L. Morgan, Stanford University, Cal.

Montana State College Branch
Chairman—Roy C. Flagen, Montana State College, Bozeman, Mont.
Secretary—J. A. Thaler, Montana State College, Bozeman, Mont.
Meetings—Third Friday of every month of the school year in the Electrical Bldg.

Throop College of Technology Branch
Chairman—J. Paul Youtz, Throop Dormitory, Pasadena, Cal.
Secretary—Clark E. Baker, Throop Dormitory, Pasadena, Cal.

State College of Washington Branch
Chairman — S. E. Stites, 301 Montgomery St., Pullman, Wash.
Secretary—E. W. Tollefson, Box 393, College Sta., Pullman, Wash.
Meetings—Bimonthly at Mechanics Art Bldg., Pullman, Wash.

CONTRACTOR-DEALER ASSOCIATIONS

National Association of Electrical Contractors and Dealers
President—Col. Robley Stearnes, New Orleans, La.
Secretary — Harry C. Brown, 41 Martin Bldg., Utica, N. Y.
Directors — California: W. D. Kohlwey, San Francisco. Oregon: Samuel C. Jaggar, Portland.
Next Convention—Cleveland, July 17-20.

British Columbia Ass'n Electrical Contractors and Dealers
President—C. H. E. Williams, 509 Richards St., Vancouver, B. C.
Secretary—R. B. W. Pirie, 406 Yorkshire Bldg., Vancouver, B. C.
Meetings—First Tuesday of each month.

California Ass'n of Electrical Contractors and Dealers
President—H. C. Reid, 507 Montgomery St., San Francisco.
Secretary—J. W. Redpath, Rialto Bldg., San Francisco.
Meetings—Monthly.

Electrical Contractors and Dealers Ass'n of San Francisco
President—J. M. Carlson, 175 Jessie St., San Francisco.
Secretary—J. W. Asher, 601 Howard St., San Francisco.
Meetings — Saturday, 12:15; Hof Brau Cafe.

Southern California Electrical Contractors and Dealers
President—G. E. Arbogast, 724 So. Olive St., Los Angeles, Cal.
Secretary—J. E. Wilson, 425 Consolidated Realty Bldg., Los Angeles, Cal.
Meetings—Every Friday at 6:30 p. m. at the Pin Ton Cafe, 427 South Broadway.

Nevada Ass'n of Electrical Contractors and Dealers
President—F. V. McAvoy, 138 N. Center St., Reno.
Secretary—R. W. Shearer, 215 Sierra St., Reno.
Meetings—Twice a month, 15th and 30th.

Oregon Ass'n of Electrical Contractors and Dealers
President — A. S. Halls, 262 Stark St., Portland.
Secretary—J. Willis Oberender, 301-2 Dekum Bldg., Portland, Ore.
Meetings—Every Saturday, 1:30 p. m.—Secretary's office.

Portland Local Ass'n of Electrical Contractors and Dealers
President—Allen S. Halls, 517 Railway Exchange Bldg., Portland.
Treasurer — J. W. Oberender, 301 Dekum Bldg., Portland.
Meetings—Saturday, 3 p.m., at 301 Dekum Bldg.

Utah Society of Electrical Contractors and Dealers
President—J. V. Buckle, Buckle Electrical Co., 70 E. 1st St., Salt Lake City.
Secretary—E. H. Eardley, Eardley Bros. Co., 37 E. 1st St., Salt Lake City.
Meetings — Every Friday noon at Commercial Club.

Washington Ass'n of Electrical Contractors and Dealers
President — V. S. McKenny, NePage & McKenny Co., Armour Bldg., Seattle, Wash.
Secretary — H. D. Alleson, 404 Oriental Bldg., Seattle, Wash.
Meetings — Quarterly—second Thursdays of March, June, September and December.

JOBBERS' ASSOCIATIONS

Electrical Supply Jobbers Association
General Secretary — Franklin Overbagh, 411 So. Clinton St., Chicago, Ill.
Meetings—Semi-annual.

Pacific Coast Electrical Supply Jobbers
President—Sam H. Taylor, 84—2nd St., San Francisco.
Secretary — Albert H. Elliot, 544 Market St., San Francisco.
Meetings—Quarterly. Last meeting: Del Monte, January 24.

Electrical Credit Ass'n of the Pacific Coast
President—C. L. Gilson, Gilson Electrical Supply Co., 304—12th St., Oakland, Cal.
Secretary — Albert H. Elliot, 544 Market St., San Francisco.
Meetings—Annually: San Francisco; May.

OF ELECTRICAL INTEREST

National Electric Light Association
President—J. W. Lieb, N. Y. Edison Co., New York City.
Executive Secretary—T. C. Martin, 33 W. 39th St., New York City.
Meetings—June.

Pacific Section, N. E. L. A.
President—H. F. Jackson, Holbrook Bldg., San Francisco.
Secretary—A. H. Halloran, Crossley Bldg., San Francisco.
Meetings—Annually, in April.
Next meeting — Del Monte, April 24-27, 1918.

Portland Section, N. E. L. A.
Chairman—C. L. Wernicke, care Westinghouse Elec. & Mfg. Co., Portland, Ore.
Secretary — R. J. Davidson, care Pacific Power & Light Co., Portland, Ore.

Illuminating Engineering Society
Meetings—First Tuesday each month.
President—G. H. Stickney.
Secretary—Clarence L. Law.
Western representative—Romaine Myers, Bacon Bldg., Oakland.

New Mexico Electrical Association
President—M. R. Buchanan, Silver City, N. M.
Secretary—E. M. Haggerson, Silver City, N. M.
Meetings—Annually, in February.
Next meeting — February 11-13, Silver City, N. M.

Northwest Electric Light and Power Ass'n
President—Guy W. Talbot, 1212 Spalding Bldg., Portland, Ore.
Secretary—Geo. L. Myers, 1212 Spalding Bldg., Portland, Ore.
Meetings—Convention held annually. Executive Committee, governing body of Association, meets upon call of its chairman.
Next convention will convene in Portland, September 11, 1918.

Los Angeles Jovian Electric League
President—H. N. Sessions, San Fernando Bldg., Los Angeles.
Secretary—W. C. McWhinney, Southern California Edison Co.
Meetings — Every Wednesday, 12 m., at Jahnke's Tavern, 524 S. Spring Street.

San Francisco Electrical Development and Jovian League
President—Robert Sibley, Crossley Bldg., San Francisco.
Secretary — J. D. Redpath, Rialto Bldg., San Francisco.
Meetings—Every Wednesday, 12:10 p. m.; luncheon, Palace Hotel.
Next meeting—February 6.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

National Officers
President—Charles T. Main, Engineering Society Bldg., New York City.
Secretary—Calvin W. Rice, Engineering Society Bldg., New York City.

San Francisco Section, A. S. M. E.
President—B. F. Raber, University of California, Berkeley.
Secretary—Chas. H. Delany, 445 Sutter St., San Francisco.
Meetings—Quarterly.

ENGINEERS' CLUBS

Oregon Society of Engineers
President—H. L. Vorse, Box 973, Portland, Ore.
Secretary—Orrin E. Stanley, Box 973, Portland, Ore.
Meetings—Annual: Feb. 4, 1918. Monthly: Third Thursday of each month.

The Engineers' Club of Seattle
President—E. B. Hussey, Alaska Bldg., Seattle, Wash.
Secretary—E. J. Bartells, Northern Life Bldg., Seattle, Wash.
Meetings—Thursday noon at the club rooms at 410 Arctic Bldg. A buffet luncheon is served every day. A special welcome is extended to all engineers visiting the city.

Engineers' Club of San Francisco.
President — B. P. Legare, 58 Sutter St., San Francisco.
Secretary—J. R. Brownell, 525 Market St., San Francisco.
Annual meeting: October.

Idaho Society of Engineers
President — W. H. Gibson, Mountain Home, Idaho.
Secretary—Ira F. Shaffner, Boise.
Annual meeting: January.

Engineers' Club of Oakland
President—R. S. Chew, Oakland Chamber of Commerce, Oakland.
Meeting: January 16. George A. Posey spoke on "The Oakland Estuary Bascule Bridge."

MISCELLANEOUS

American Ass'n for the Advancement of Science—Pacific Division
President—D. T. MacDougal, Director Desert Laboratory, Carnegie Institution, Tucson, Arizona.
Secretary (acting)—J. R. Douglas, 430 Library, University of California, Berkeley, Cal.
Meetings—Annual. Next meeting—March 28-30, 1918, Throop College of Technology, Pasadena, Cal.

American Chemical Society—Oregon Section
Secretary—Norman C. Thorne.

Foreign Trade Club
President — W. H. Hammer, Monadnock Bldg.
Secretary — Wm. E. Hague, Monadnock Bldg.
Meetings—238 Merchants Exchange Bldg., San Francisco. Every Wednesday evening.

Pacific Coast Gas Association
President — John D. Kuster, care Pacific Gas & Electric Co., San Jose, Cal.
Secretary—Henry Bostwick, 445 Sutter St., San Francisco.
Meetings—Annual. Next convention—September, 1918, in Los Angeles.

Society for Promotion of Engineering Education
Secretary—F. L. Bishop, University of Pittsburg, Pittsburg, Pa.

HAPPENINGS IN THE INDUSTRY

Personal Items

M. J. Walsh left Portland, Ore., for an extended stay in California, and the M. J. Walsh Electric Co., the new name of the 311 Stark Street Electric Store, is under the able management of S. W. Bridges, secretary-treasurer of the company.

F. M. Nourse has joined the advertising department of the Cutler-Hammer Manufacturing Company of Milwaukee, in the capacity of technical writer. In 1915 Mr. Nourse took charge of the Portage, Wisconsin, division of the Wisconsin Power, Light & Heat Company, and later became associated with the Electrical Engineers' Equipment Company of Chicago.

William Shore Smith of Eugene, Ore., will represent in Oregon the Mountain State Power Company, capitalized at five million dollars, which has been issued a permit to operate in Oregon.

B. Badrian, formerly with the Pacific States Electric Co., and for the past year a part of the Hurley Machine Company's selling organization, representing the company on the Pacific Coast, has just finished a two weeks' visit at the company's new factory in Chicago.

Changes and Beginnings

E. G. Robinson Electric Co., formerly at Arlington, Wash., is now located at Canby, Oregon.

The Grand Electric Co., of 127 Grand avenue, Portland, Oregon, report the completion of a large power installation at the Hesse-Martin Iron Works.

The warehouse and sales office of the Western Electric Company at Seattle, Wash., has just moved into new quarters at 84 Marion street.

The Mountain State Power Company, capitalized at $5,000,000, a corporation organized under the laws of De'aware, with principal offices at Wilmington, has been issued a permit to operate in Oregon. It will be represented by William Shore Smith of Eugene, and presumably its center of operation will be at that place. Officers and directors are all Chicago men.

Goldsborough Telephone Company, of Shelton, Wash., has applied to the county commissioners for a 25-year franchise for constructing, operating and maintaining telephone lines in certain sections of the county.

Ford, Bacon & Davis, engineers, announce the formation of the Ford, Bacon & Davis Corporation, organized for the purpose of conducting a general contracting business, with particular reference to industrial, public utility and power plants, steam and street railroads, docks, steamship and railway terminal facilities, subways, tunnels, hydro-electric and irrigation projects. Its headquarters are at 115 Broadway, New York, with offices at New Orleans and San Francisco.

The Wagner Electric Manufacturing Company, of St. Louis, announces the removal of its Seattle office to 535 First avenue, South, to continue in charge of Mr. C. Kirk Hillman.

Hughson & Merton has moved from 530 Golden Gate avenue to 77 O'Farrell street. This company now represents the following concerns: Chelten Electric Co., Clifton Manufacturing Co., Eagle Glass and Manufacturing Co., Franklin Steel Works, F. J. Meyers Manufacturing Co., H. Northwood Co., W. R. Ostrander Co., National Metal Spinning and Stamping Co., Electric Cable Co., American Vulcanized Fibre Co., Ericsson Manufacturing Co., and the Trenton Porcelain Co.

The Bay Point Electrical Supply Company has bought a lot on Main street, Bay Point, and will immediately commence the erection of an electrical shop. The building is for the offices of the Bay Point Light & Power Company, the Bay Point Building Materials Company, and the Electrical Supply Company.

At its new branch, 722 Market street, San Francisco, the Western Union has installed a typist to whom the public may dictate messages without charge. This plan originated at the Los Angeles office and will be extended to other Western Union offices.

Copies of articles of incorporation have been filed by the Beaver River Power & Light Company, of Salt Lake city. The company is formed under the laws of Delaware and will operate in Beaver county, Utah, holding meetings at Provo. The capital stock is $400,000. Incorporators are C. L. Rimlinger of Wilmington, Del., M. M. Clancy of Wilmington, Del., and Clement M. Egner of Elkton, Md.

Prospects for New Business

The erection of a gigantic steel and pig-iron manufacturing plant on Puget Sound is vouched for by the authorities, who assert that construction will commence as soon as permission to buy necessary machinery and equipment is obtained from the General Defense Board. The reported initial units of the plant will cost $9,000,000, and the fully completed project approximately $25,000,000. The establishment of the plant will mark the beginning of the greatest period of industrial development the Northwest has ever known, and will presage the location of numerous industries utilizing steel as raw material.

Recently contracts for twenty steel steamships of 8800 tons capacity, to cost approximately $40,000,000, were awarded to Portland shipbuilders by the United States Shipping Board. These are the first contracts granted the steel ship-yards in Portland.

The Whalen Pulp & Paper Company, Ltd., of Vancouver, B. C., is building up a vast industry where their hydro-electric system will develop eventually 20,000 horsepower.

The latest addition to the activities centering around Astoria's new municipal dock is the plant of the Astoria Marine Iron Works, which has entered into an agreement with the Port of Astoria to use a portion of pier 2 for the operation of a marine machine and iron working plant. A contract has been entered into between the machine plant and the Pacific Power and Light Company for 100 horsepower in motors. The electrically operated coal handling equipment at the port docks has also been placed in operation, and will be used by many steamers and government vessels, who will make Astoria a port of call on account of these facilities.

The report of the light department of the city of Tacoma, Wash., shows that during November, 1916, the average amount of power used daily was 107,000 kilowatts per hour and the average for November, 1917 was 163,000 kilowatts per hour each day.

Rate Increases

Applications for increased rates have been filed by the Gas and Electric Company of San Jose, Cal.; Winnipeg Electric Railway of Canada, and the Pacific Power & Light Co., Lewiston, Idaho.

The California Railroad Commission has decided that government railroad control will not affect the applications for rate increases which electric railways have filed. This news has strengthened electric railway securities, and, with the freight business these lines are developing, the prospects in this field are much better than they have been.

Rate-Base Valuation

The engineering department of the Washington Public Service Commission has completed valuation of the Washington Water Power Company electric system in the Inland Empire, including a part of Idaho. As fixed by the engineering department, but not yet formally passed upon by the commission, the company's property in Washington is valued at $21,624,595, and in Idaho at $2,491,823, or a total of $24,116,418, not including power site valuations.

New Business for the Pacific Gas & Electric Co. of Arizona

The Pacific Gas & Electric Company of Phoenix, Ariz., has executed a contract with the Southwest Cotton Company, a subsidiary of the Goodyear Rubber Company, for 1200 k.w. of power for pumping and ginning. The Southwest Cotton Company has now contracted a total of 1800 k.w. for this purpose.

Thirty-five hundred additional acres of desert land will be developed this spring and planted in long staple cotton. The Southwest Cotton Company has invested over $2,500,000 in Salt River Valley, Arizona, within the last year and will greatly increase this investment during the coming year.

Long staple (Egyptian) cotton of Pima variety, grown in the Salt River Valley is yielding this year between 76c and 80c a pound, and it is expected that 100,000 acres will be planted in cotton this year.

Financial

The directors of the Crocker-Wheeler Company, electrical machinery manufacturers of Ampere, N. J., have announced that the regular dividends of 1¾ per cent on the preferred and 2 per cent on the common stock would be paid for the last quarter of 1917.

The American Gas & Electric Company has declared an extra dividend of 2 per cent on the common stock and the regular quarterly dividend of 2½ per cent on the common shares, both payable January 2d to stockholders of record December 18th; also the regular quarterly dividend of 1½ per cent on the preferred stock, payable February 1st to stockholders of record January 18th.

The Portland Railway, Light & Power Company has submitted the following report:

	1917.	1916.
October gross	$ 522,294	$ 459,720
Net after taxes	198,966	211,313
Surplus after charges	22,102	30,033
Twelve months gross	5,895,640	5,429,252
Net after taxes	2,623,267	2,385,300
Surplus after charges	462,564	207,053

Oakland Municipal Railway

Mayor John L. Davie of Oakland recently in a message to the City Council recommended the municipal owenrship of the street railway system of the east bay cities. The city council adopted the recommendation and took first steps to make effective the project of acquiring the lines. The council directed the appointment of a citizens' committee to work at once upon plans.

Railroad Commission Application

A 20 per cent raise in the price of electricity for nearly all users with the exception of "domestic consumers," was asked by the Great Western Power Company and the Pacific Gas & Electric Company, in an application filed with the California Railroad Commission. With the exception of railroads and other utilities, state and Federal departments, municipalities and domestic consumers, the two big electric companies ask authorization to raise their rates to industrial, agricultural and commercial users.

Seattle Six-Cent Fare

The Washington State Public Service Commission states that in order to enable the Puget Sound Traction, Light & Power Comuany to meet the situation more adequately, the company might have a hearing at once on a petition to advance the fare on street cars from 5 to 6 cents, as was done some time ago in Portland.

Zone Rates Asked

The Pacific Telephone & Telegraph Company has filed with the Public Service Commission a proposal for the establishment of a new system of long distance rates in Oregon, the proposed system to be established on the zone or block basis, similar to the systems used by the telegraph and express companies. The proposed changes will be passed upon by the commission, probably at a formal session, before any decision is made as to their acceptance.

Portland Six-Cent Fare

The Public Service Commission of Oregon has permitted the Portland Railway, Light & Power Company to increase its fares to 6 cents.

New Power Site Reserve

The Secretary of the Interior recently recommended, and the President has approved, the inclusion within a power-site reserve of about 196 acres of public land in the Big Sandy River Basin, Ore., in order that this land may be used in connection with the development of power, but not for other purposes. The withdrawal for power-site purposes of a tract within the El Dorado National Forest, Cal., has also been recommended by the Secretary of the Interior and approved by the President.

Crocker-Wheeler Bonus

To meet unusual conditions incident to the war, Dr. Schuyler S. Wheeler, President of the Crocker-Wheeler Company, electrical machinery manufacturers of Ampere, N. J., recently announced a bonus under which its employes will receive not less than 10 per cent of their wages since October 1, 1917, and during the coming year. All employes receiving less than $2500 yearly will benefit and those who have been in the employ of the company for more than a year will receive 12 per cent of their earnings.

Abandonment of Unprofitable Line

The Utah Public Utilities Commission holds in a case affecting the Emigration Canyon Railroad Company that a railroad company makes out a case for the abandonment of its road where it is shown that the purpose for which it was built has ceased to exist, that the road is operated at a loss, that there is no prospect for any change in the situation, and where it appears that there is no question as to connection with other railroads or any charter or other obligations to estop it. The mere fact that numerous persons have purchased land and made improvements thereon in the belief that a railroad will be operated is not, as a matter of law, a sufficient reason to require its continuance.

BOOKS AND BULLETINS

Testing Current Transformers

A new publication of the Bureau of Standards (Scientific Paper No. 309), entitled "A Method for Testing Current Transformers," was issued November 3, 1917. A general method is outlined in this paper for the determination of the ratio and phase angle of current transformers in terms of the constants of previously calibrated standard transformers of the same nominal ratio. It has been shown that such methods are essentially more sensitive, or conversely, may be used with much less sensitive instruments, than the laboratory methods now in use for the absolute determination of the ratio and phase angle of a single transformer. Two of the most convenient of the many possible modifications of the general method are described in detail. It is hoped that the methods will be found useful in commercial plants where delicate laboratory equipment is not available, and where large numbers of transformers must be tested rapidly and with moderate accuracy.

Central Stations

by Terrell Croft, Consulting Electrical Engineer; size 8x5½; 330 pp.; published by McGraw-Hill Book Company, Inc., New York City, and for sale by the Technical Book Shop, San Francisco. Price, $2.50.

Mr. Croft has presented his subject so simply that it can be readily studied by the reader of modest mathematical attainments. The different factors which are utilized frequently in central station practice are discussed exhaustively. Following the treatment of fundamentals, the elements of transmission and distribution are examined. Final chapters in the book concern electrical-energy generating stations and their equipment. In connection with the text numerous illustrations are given showing modern central-station practice.

LATEST IN EVERYTHING ELECTRICAL

(With the present extensive use of high-head Francis turbines, it is interesting to note that 1906 marked the installation of the first of this type for operating heads over 400 feet. The history of this development and the present standing of the various types of turbines for high-pressure service, is interestingly described in the following article. The author is consulting engineer in the hydraulic department with the Allis-Chalmers Manufacturing Company.—The Editor.)

HIGH-HEAD FRANCIS TURBINES AND THEIR OPERATING RECORDS

BY ARNOLD PFAU

The application of the Francis turbine in its early stage of development was rather limited to a narrow range of head, due to a number of circumstances.

The early design of the Francis turbine followed the principal characteristics of its forerunner, the Jonval-Turbine (axial-discharge, reaction-turbine). This may account for the limitations in the application to extremely low heads and to high heads.

The character of the commercial development also greatly influenced the progress made, inasmuch as all energies were concentrated towards the production of stock articles, with a view of quickly conquering the new and vast market, rather than towards a real perfection and development purely from an engineering point of view.

Finally, the fact should not be overlooked that the early Francis turbine appeared at a time when electrical transmission of energy was practically unknown. The use of turbines was, therefore, limited to direct mechanical transmission by gears, belts, ropes, etc., all of which did not permit of high speeds or of large capacities.

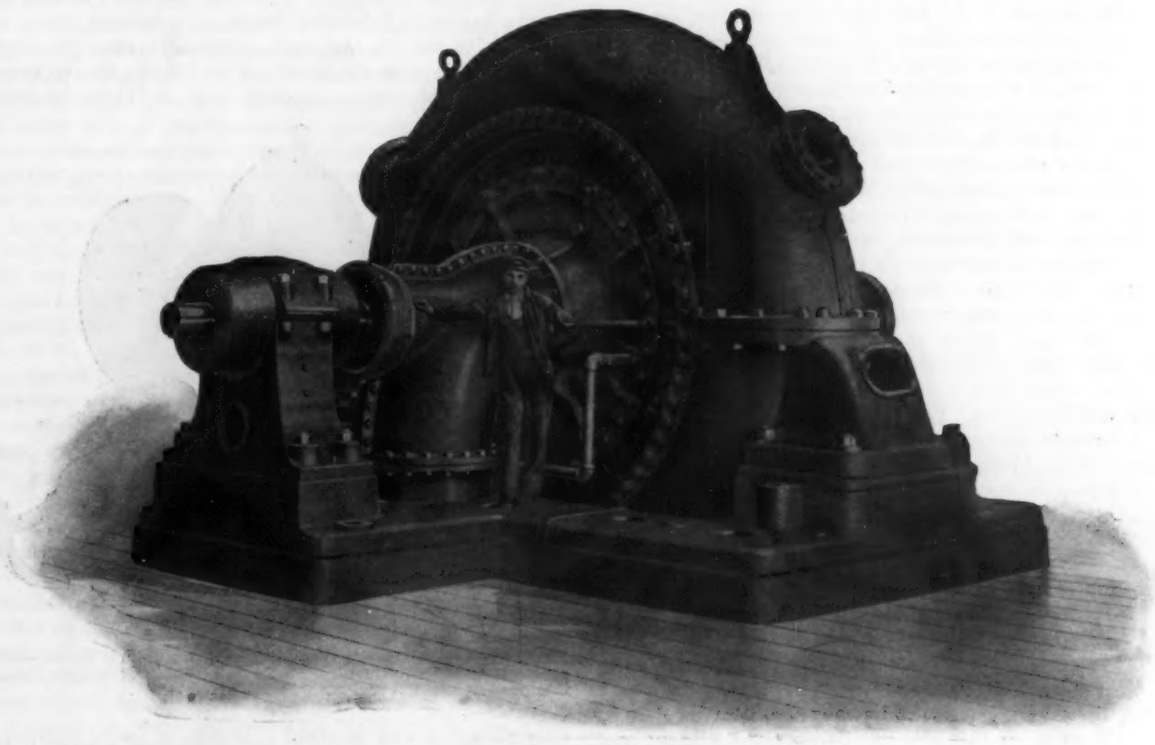
With the development of electrical transmission of energy an enormous field of application of water power was at once opened up. The ever increasing demands in regard to speed and capacity of turbines suitable for direct connection with generators, and the greater possibilities for commercial development of water power with heads heretofore outside of the practical range, made it imperative to develop the hydraulic prime movers to such an extent that they now cover the entire range of head found within the limits of nature.

The intense studies made have brought about an almost entire elimination of the numerous designs previously used, and today we find only two principal types applied—the Francis type, or reaction turbine, and the impulse type, or action turbine.

The Francis turbine is adapted for low and medium heads exclusively and for moderately high heads when large capacities are involved.

The impulse wheel is limited to very high heads exclusively and moderately high heads when moderate capacities are involved. From the above it follows that there is a so-called twilight-zone of application of both types.

For a fixed head and a required capacity, the quantity of discharge of a hydraulic prime mover becomes fixed. This in turn limits the total area of the passageways of the runner of a Francis turbine (or the throat area of the nozzle of an impulse wheel). The speed of the prime mover fixes the diameter of the runner, which in turn also affects the passage area of the Francis runner, or the ratio of wheel diameter to jet diameter of an impulse wheel. Consequently the individual passage areas of a Francis runner decrease as the head increases and the ratio of the wheel diameter to jet area

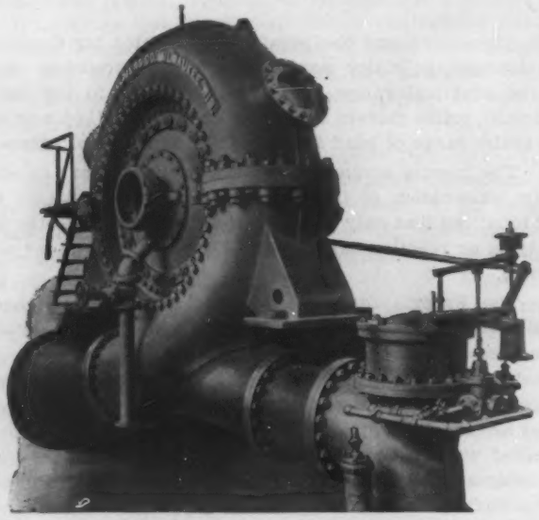


AN IDAHO INSTALLATION

Double discharge Francis turbine, 440 ft. head, 8500 horsepower, 300 revolutions per minute. Two built in 1907 for Telluride Power Company, Bear River Plant, Idaho

of an impulse wheel decreases as the head increases, and also as the capacity increases. We thus approach conditions where the design of a Francis turbine becomes impractical because of uncommercially high speed of the generator for a given capacity, or because of too great capacity for commercial speed.

Similarly, conditions will be found where the design of an impulse wheel (even with a multiple arrangement of jets) becomes impractical, because of uncommercially low speed



Single discharge overhung Francis turbine, 450 ft. head, 7000 horsepower, 450 revolutions per minute. Three built in 1911, for Northern California Power Company, Coleman Plant, California.

for a given capacity, or because of too small capacity for a commercial speed.

"From the above it follows that the practical limits of application of an impulse wheel in the direction of the lower heads is pretty well fixed, whereas the limits of application of the Francis turbine in the direction of the higher heads to some extent permits of greater and greater development as the required capacity of the unit is increased, and as the load conditions of such a generating unit permit of operation at a continuously fair gate-opening, or load factor."

Aside from the question of correct design of a high-head Francis turbine runner, from the point of view of hydraulic wear and tear, the problem of properly taking care of the end thrust was one which greatly impeded the application of the single discharge type of turbine. To avoid the dangerous end thrust the double discharge type was employed and is still being used. The runner divides the operating water into two quantities, discharging each separately through a quarter turn and draft tube. While this type eliminates to some extent the end thrust, it has several decidedly undesirable features. The wetted area is greatly increased, which in turn increases friction losses. The runner must be placed at the point of greatest deflection of the shaft, thus making it necessary to have a large diameter of the latter, which in turn offers an excessive obstruction to the flow of water.

With the introduction of the single discharge turbine, and particularly with the overhung type, the runner can be placed close to one of the main generator bearings and no shaft of appreciable dimensions, if any, is required in the quarter turn side. The much feared end thrust can be taken care of absolutely reliably by a hydraulic balancing device formed by the side walls of the runner and the adjacent walls of the cover plates. By properly designing these balancing chambers the runner is forced to rotate with a negligibly small end motion, so that it could be operated without any mechanical thrust bearing, were it not for the first periods of starting and the last periods of stopping of the turbine.

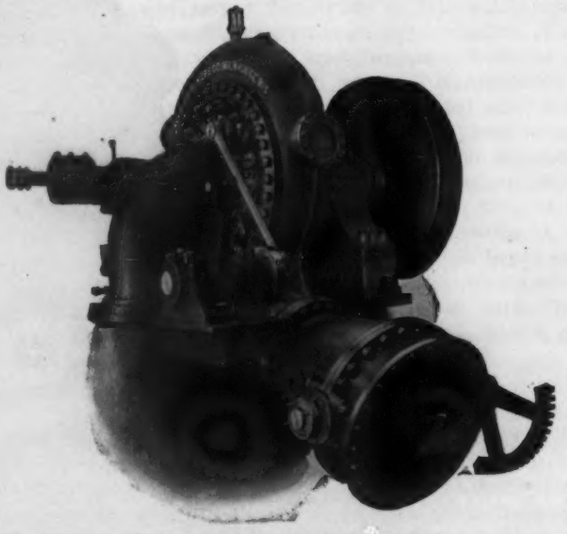
Successful Francis turbines for operating heads exceeding 400 feet were an unknown quantity prior to 1906. A few attempts to install this type were made at an earlier date, the results, however, were such that it seems to be advisable to eliminate same from the records.

It affords the writer particular pride to state here, that it was a California engineer, Mr. F. G. Baum, whose efforts and farsightedness made it possible to secure the contract for the then most powerful single discharge Francis turbine for operation under a net head of 550 feet, and that it was a California power corporation which had the confidence in their engineer's judgment and the manufacturer's ability to furnish a turbine which would prove a success even for requirements so vastly more severe than anything previously attempted.

The results obtained with this turbine are a monument to all who took an active part in the work, results, which have proved to be the milestone on the road to the successful development of the modern high-head Francis turbine.

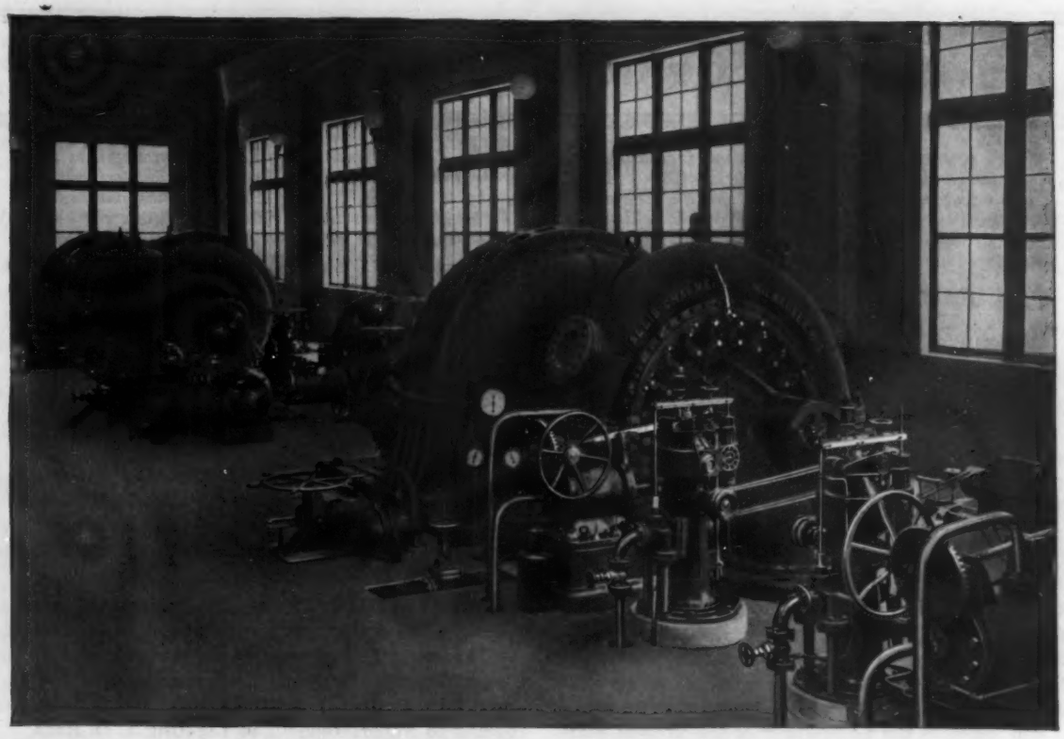
In summer of 1907, this unit was placed in commercial operation at the Centerville plant of the Pacific Gas & Electric Company, and it has since delivered power almost uninterruptedly. In spite of the fact that the speed of 400 R. P. M. was fixed by the purchase of the generator in advance of that of the turbine, being first intended for operation in connection with a multiple jet impulse wheel, so that the speed was lower than desirable, for obtaining best results with a Francis turbine, nevertheless the hydraulic wear and tear proved to be exceedingly small. During about seven years of operation, the runner, guide vanes, and other parts in contact with the water flowing at high velocity, required no replacement, and the wearing qualities of these parts proved to be at least equal to what it would have been possible with the corresponding parts of an impulse wheel. The efficiency of the unit remained practically constant, and, exceeding 86 per cent at all periods, was higher than could have ever been obtained with an impulse design, especially one embodying a multiple jet arrangement.

With the exception of an improvement in the design of the hydraulic balancing device as a natural result of the progress of the art, this unit is today the same as originally designed. Its splendid operating record has proved beyond a doubt that the correct application of a Francis turbine for



Single discharge Francis turbine, 550 ft. head, 4000 horsepower, 720 revolutions per minute. Two built in 1911, for Cleveland Cliffs Iron Company, Carp River Plant, Michigan.

high heads is well justified and that it offers manifold advantages over that of an impulse wheel under identical operating conditions.



CITY PLANT, TACOMA, WASH.

Single discharge overhung Francis turbine, 450 ft. head, 8000 horsepower, 450 revolutions per minute. Four built in 1911, for city of Tacoma, Nisqually Plant, Washington.

When a novel design is in the progress of its making it is sometimes possible for the experienced designers to form a reliable idea whether it is going to be a success or a failure. The success of this new turbine was so distinctly projected on the vision of the engineers that it was felt unnecessary to await actual results in operation, and it was decided to vigorously conquer the new territory opened.

During the period of construction of the Centerville turbine, two 8500 hp. turbines for 440 feet net head were built for a speed of only 300 revolutions per minute. Here also the generator contract was let in advance of that of the Francis turbine, which required a special design of runner, owing to the relatively low speed. The speed had been selected to suit the hydraulic characteristics of the so-called Victor turbine and action-type of turbine. Sad experience with this turbine has since resulted in its entire expulsion from practical application. The troubles encountered with the thrust bearings of that type of turbine were so deep rooted in the minds of the engineers that they insisted upon a double discharge design in order to avoid excessive thrust. Introducing the double discharge feature at this low speed greatly increased the danger of pitting the runner, guide vanes and removable liners of the guide case walls. Notwithstanding the very unfavorable conditions, these units have given entirely satisfactory service, a replacement of the wearing parts having been made only once during the ten years of operation. The success evidenced by the performance of these pioneer turbines was the beginning of an extensive development of high-head Francis units. The victory of the Francis turbine over that of the action type of turbine was so complete that not only did it stop a further application of the same, but even led to a number of replacements of action-turbines, and even impulse wheels, by low-speed Francis turbines.

Among the many replacements we may cite the Olmstead plant of the Telluride Power Company at Provo, Utah. Here, three action-turbines were replaced by overhung single discharge Francis turbines, each of 3600 hp. under 330 feet head at 300 revolutions. The runner was placed directly upon the end of the existing generator shaft and the whole reconstruction of the hydraulic end of the plant was accomplished without even removing a single part of the generator.

Through the efforts, in 1908, of the late Mr. W. R. Eckart, consulting engineer of San Francisco, the third unit for the Potter Valley Plant of the Snow Mountain Water & Power Company, a 4000 hp. Francis turbine for 450 feet head and 450 R. P. M., was made of the single overhung type. Its excellent records, only one replacement of the renewable parts, was the leading factor in the award of the contract of the fourth unit, which is practically a duplicate of the previous order.

Where it was possible to select the type, speed and capacity so as to best suit the operating head, the wear and tear proved to be a minimum. As an example, we may cite a few such plants:

Coleman Plant, California, of Northern California Power Company. Three 7000 hp. units 450 R. P. M., 450 feet head, operating since 1911; no replacements.

Prospect Plant, Oregon, of Rogue River Electric Company (now California-Oregon Power Company). One 6300 hp. unit, 514 R. P. M., 487 feet head; operating since 1911; no replacements.

Carp River Plant, Michigan, of Cleveland Cliffs Iron Company. Two 4000 hp. units, 720 R. P. M., 550 feet head; operating since 1911; no replacements.

Nisqually Plant, Washington, owned by City of Tacoma. Four 8000 hp. 450 R. P. M., 410 feet head; operating since 1911; no replacements.

One of the most recent repeat orders establishes a new world's record for size of unit of the type in question. It is a 25,000 hp., single, spiral-casing Francis turbine operating under 440 feet net head at 360 revolutions per minute. It is the largest horizontal shaft unit in existence and regardless of type, it is exceeded only in power by the three 31,000 hp. vertical shaft units which were furnished by the same manufacturer and which have been in commercial operation for five months at the Narrows Plant of the Tallassee Power Company, at Badin, N. C.

NEW ELECTRICAL DEVELOPMENTS

(The past two weeks have marked increasing activity in the Pacific Northwest. The government has reversed its decision in regard to the Skagit River power project, and the city of Seattle has authorized the issuing of utility bonds for five million dollars. The Alaska Gastineau Mining Company has planned a twenty-five million dollar mill which will call for a large new power load. In the Southwest the control of the Colorado River is receiving attention in Los Angeles, as well as in the border agricultural districts.—The Editor.)

THE PACIFIC NORTHWEST

PORT MOODY, B. C.—The Aetna Steel Works here will install a six-ton electric smelter furnace.

COLFAX, WASH.—The city council recently granted the Pacific Telephone & Telegraph Company a ten-year franchise to operate in the city.

NELSON, B. C.—Application has been made to the council of the Kootenay General Hospital for the installation of an electric lighting system to cost about $1,180.

VANCOUVER, B. C.—An electric lighting plant, it is understood, will be installed at the ship-building yards of J. J. Coughlan & Sons; also 12 electrically operated cranes.

EVERETT, WASH.—Norway-Pacific Construction & Dry Dock Company, of Seattle, will construct a $1,000,000 shipyard and drydock in Everett. M. G. Thomle, president, Seattle.

TACOMA, WASH.—City officials are planning an additional storage system for the municipal power plant at La Grande that will increase the horsepower of the present plant 17,500.

TACOMA, WASH.—Plans are being considered for placing the electric wires of the municipal electric light department under ground, for which estimates of cost are being prepared.

EUGENE, ORE.—N. C. Nelson, engineer for the Eugene, Ore., water board, reported that it will be possible to develop 5000 theoretical or 3600 actual horsepower for the use of the power plant at Walterville.

VANCOUVER, B. C. — Amendments to city by-laws adopted by the Vancouver city council recently provide that jitney competition against the B. C. E. R. Company will be prohibited after April 1, 1918.

CHEHALIS, WASH.—O. E. Anderson of Portland has presented a franchise to the city for an electric light and power business here that will come into competition with the North Coast Power Company.

SEATTLE, WASH.—The Electric Manufacturers' Agency of Seattle, has filed articles of incorporation with a capital stock of $20,000. The incorporators are Joseph Schoemer, George Buckman and W. Funfsinn.

SEATTLE, WASH.—The Seattle Mechanical & Electro Plating Company., of Seattle, has filed articles of incorporation with a capital stock of $2,500. Filed by Longfellow & Fitzpatrick, 1001 Smith Building, Seattle.

PRINCE RUPERT, B. C. — The Prince Rupert Hydro-Electric Company has offered the city the Falls River power site, including improvements on it, for $34,000 in municipal bonds and the offer is being given consideration.

VICTORIA, B. C.—Changes amounting to $25,000 have been planned by the Canadian Refrigerating Plant. The capacity of the plant will be increased and it will be equipped for electrical operation. Special motors and machinery will be installed.

WALLA WALLA, WASH.—The Lower Mud Creek Telephone Company has petitioned the Walla Walla county commisioners for a 50-year franchise to construct, maintain and operate a telephone and telegraph line over certain roads in the county.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has started work on the building of the superstructure of its coal pulverizing plant adjoining the power site on Western avenue and Seneca street, which will cost $75,000.

SEATTLE, WASH.—Plans are being prepared for the construction of a sub-station for the city lighting department at West Forty-ninth street and Fourteenth avenue, N. W., one and two stories high, 66x66 feet. The estimated cost is $7,000. Daniel Huntington, city architect.

TRAIL, B. C.—The West Kootenay Power & Light Company contemplates extending its electric transmission line to the property of the Canada Copper Company at Princeton to furnish electricity to operate the proposed 3000-ton concentrator which the company is planning to build.

SEATTLE, WASH. — Construction of a steam power plant on the water front with sufficient capacity to furnish 12,500 kilowatts of electric power and steam sufficient to heat the buildings in the district between Madison and Main streets and Third avenue and Elliott Bay, would cost $600,000, according to Superintendent of Lighting J. D. Ross.

VANCOUVER, WASH. — A great lumber cut-up plant providing raw material for aeroplanes will be erected and operated by soldiers. The new plant will be 350 by 400 feet in size, and will be equipped with electrically operated machinery capable of working up 300,000 feet daily. The cost is estimated at $200,000, and February 15th is the probable date of completion.

SEATTLE, WASH.—An electrically operated steel plant will be erected on Puget Sound, near here, as a result of the choice made by the Alaska Gastineau Mining Company in chosing a site for its recently formed company. The enterprise is said to involve the sum of $25,000,000, of which $9,000,000 will be spent on the plant's first unit. Work is expected to begin shortly. The concern is composed of a number of San Francisco financiers, among whom are B. L. Thane, S. F. B. Morse, W. H. Crocker and others.

SEATTLE, WASH.—The city has been granted a permit by the government to develop the Skagit river power project in the national reserve. For this utility bonds in the sum of $5,000,000 have been authorized. Bids for constructing such a plant will be received by the Board of Public Works up to 10:00 o'clock a. m., March 1, 1918. The city is also given priority right to the remainder of the river, this temporary permit to remain in force up to May 15, by which time the city shall place in the hands of the Federal department its plans for the ultimate development of the upper and greater site. Specifications are ready for the bidders. Twenty-five thousand kilowatts will be developed by this first unit, or about 33,000 horsepower.

THE PACIFIC CENTRAL DISTRICT

STOCKTON, CAL. — Construction work is progressing steadily on the $1,250,000 plant of the National Paper Products Company just west of Stockton. About 600 people—all skilled labor—will be employed.

BROOKDALE, CAL.—The Mountain Light & Water Company of Brookdale has petitioned the State Railroad Commission for permission to discard its flat rates and install meters in the residences of its patrons.

FRESNO, CAL.—The contract for the construction of an electrolier system from G and Fresno streets to the city

limits on Kearney avenue was awarded to the Lewis Electrical Company of Fresno. The bid was $18,300.

ROUND VALLEY, CAL.—The application of the Interstate Telegraph Company for permission to collect from Round Valley telephone patrons according to the company's schedule of rates, has been granted by the State Railroad Commission.

LA GRANGE, CAL.—The Railroad Commission has authorized the Sierra & San Francisco Power Company to use $13,670 from the sale of its $1,000,000 bond issue for additions and improvements to the La Grange division of the Yosemite Power Company, recently purchased by the company.

SAN FRANCISCO, CAL.—Receiver John P. Coghlan of the Northern Electric Railway Company sought an order from United States District Judge Dooling, authorizing the purchase of an additional electric motor of sixty tons at a price of $37,500.

CHICO, CAL.—The city council is considering a proposal submitted by the Northern California Power Company for lighting the streets of the city for a period of four years. The company agrees to furnish electricity to maintain the entire system at $275 per month. The contract provides for larger lamps in the residence districts.

BISHOP, CAL.—The Nevada-California Power Company is contemplating the construction of a high-voltage line to Ely, Nevada, calling for increased power facilities on Bishop Creek, and involving the expenditure of approximately $300,000 for the construction of a pole line.

OAKLAND, CAL.—The Kings Electric Company, Oakland Bank of Savings Building, has been awarded contract for electrical work in public library building at Fifty-sixth street and San Pablo avenue, at $1,955; also for public library building at Fifty-second street and Telegraph avenue, at $1,955.

WOODLAND, CAL.—Electricity for Guida, Rumsey, Brooks and environs will be supplied by the Pacific Gas & Electric Company within a few weeks. The local men will go to Dixon to determine what connection would have to be made to furnish the western Yolo towns with electricity. Guida and the other nearby stations all come in the Solano district.

REDWOOD CITY, CAL.—Bids will be received up to February 4th for installing and maintaining on the Lomita Park Highway Lighting District thirty-one 40-watt tungsten lamps to burn 3000 hours per year, under a five-year contract; also for installing and maintaining on the Belmont Highway Lighting District thirty-nine 60-candlepower and eight 100-candlepower tungsten lamps under a five-year contract.

THE PACIFIC SOUTHWEST

LOS ANGELES, CAL.—B. B. Bell Company has incorporated with a capital stock of $30,000 to manufacture lighting fixtures, etc.

RIVERSIDE, CAL.—The National Ice Company, it is understood, is contemplating using electricity instead of water power to operate its plant.

LOS ANGELES, CAL.—Specifications for installing and maintaining a lighting system in the Athens Lighting District have been adopted, and bids called for.

SILVER CITY, N. M.—The large Diesel engine in the plant of the Silver City Power Company was recently damaged by an explosion, causing a loss of about $10,000.

KINGMAN, ARIZ.—The Mormon Church has been asked to appropriate $25,000 for the building of a storage dam on the Virgin River, Arizona, to generate power for the operation of a flouring mill and cotton gin.

CORONA, CAL.—The Southern Sierras Power Company, which operates in Inyo, Kern, San Bernardino and Riverside counties, is planning to take over the property and holdings of the Corona Gas & Electric Light Company, which operates in Riverside county.

SANTA MONICA, CAL.—Sealed bids will be received by the city council for the construction of an ornamental lighting system, consisting of ornamental reinforced concrete lighting posts with wires, pipes, conduits, lamps, etc., on both sides of Colorado avenue.

LOS ANGELES, CAL.—The board of supervisors has adopted an ordinance granting the Pacific Electric Railway Company a franchise to construct and operate an electric railway on certain highways and public roads in Los Angeles county for a period of 40 years.

SAN BERNARDINO, CAL.—Extensive improvements are contemplated by the Atchison, Topeka & Santa Fe Railroad Company at its local works, which include the construction of a new blacksmith shop, an electric power plant and subway. The cost is estimated at $240,000.

CARLSBAD, N. M.—The Carlsbad Light & Power Company has been incorporated with a capital stock of $150,000 to construct and operate an electric light plant in Carlsbad. The corporation is contemplating the installation of a steam auxiliary plant and proposes to use oil for fuel.

RIVERSIDE, CAL.—The Board of Public Utilities Commission has decided to offer for sale to the Southern California Edison Company all the city pole line north of the city limits, provided it will move the point of delivery from Palm and Mount Vernon avenues in San Bernardino county to the Riverside city limits on La Cadena drive.

EL CENTRO, CAL.—The Los Angeles Chamber of Commerce has taken the initiative in a definite movement to provide for the control of waters of the Colorado River. The estimated cost of seven storage basins is $50,000,000. It would be possible to irrigate four to five million acres of rich land. The cost of hydro-electric plants is not included in this $50,000,000 estimate.

LOS ANGELES, CAL.—Mayor Woodman has outlined a plan whereby it may be possible to provide funds to complete the city's power plant No. 2, thus opening the way for the early generation of 25,000 additional horsepower. The mayor said the sinking fund could be utilized to buy a block of the $1,020,000 Hollywood water bonds, thus releasing a large amount of public service commission funds to start the work.

INTER-MOUNTAIN DISTRICT

LIVINGSTON, MONT.—A new ornamental lighting system has been installed here.

RUPERT, IDAHO — The Eastside Electrical Company has been organized to supply the community with electricity.

SANDPOINT, IDAHO—The city is considering the purchase of the Sandpoint Water and Light Company for $150,000.

SALT LAKE CITY, UTAH—A permit has been granted the Latter Day Saints Church to erect a power plant, to cost about $30,000.

CARSON CITY, NEV.—The board of city trustees is considering extending the street lighting system throughout the city. The Truckee River General Electric Company of Reno furnishes electrical service in Carson City.

PAUL, IDAHO — The foundation of the substation has been built and most of the superstructure erected. One of the wasteways to be built on the pumping unit has been completed and the contract for building the remaining four has been awarded.

BOZEMAN, MONT.—The lighting plant here will be rebuilt. It is proposed to erect a new building, in front of which the fire hall would be placed, and connect the two, using the heat from the plant to keep the fire apparatus in shape for instant use.

SALT LAKE CITY, UTAH—Frank W. Ferris of Gold Hill is installing a power plant on Trout Creek at a point about 46 miles from Gold Hill, for the purpose of generating electric current for use at mines in the Gold Hill, Clifton, Willow Springs, Fish Springs, Ferber and other mining districts. The plant will cost about $50,000, while the transmission lines will call for an additional investment of capital.

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